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JOURNAL

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

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EDITED BY

W. S. MILLARD,

R. A. SPENCE and N. B. KINNEAR.

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SEPT. 1913. VOL. XXII. No. 2.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U.

PART X.

With Plate X.

(*Continued from page 12 of Volume XXII.*)

PTEROCLES FASCIATUS.

The painted Sand-Grouse.

Indian Grouse.—Latham, Gen. Syn. ii, p. 752 (1783).

Tringa fasciata.—Scop., Del. Flor et Faun., pt. ii, p. 92 (1786).

Pterocles fasciatus.—Gray, List B., iii, p. 49; Blyth, Cat. B. As. Soc. Mus., p. 249; Jerdon, B. of Ind., iii, p. 498; King, Jour. A. S. B., xxxvii, pt. ii, p. 216; Blanford, *ibid*, xxxviii, pt. ii, p. 188; Hume, *ibid*, xxxix, pt. ii, p. 139; McMaster, *ibid.*, xl., pt. ii., p. 214; Stoliczka, *ibid*, xli, pt. ii, p. 249; Hume, Nest and Eggs, p. 511; Adam, Str. Feath., 1, p. 391; Ball, *ibid*, ii, p. 426; *id*, *ibid*, iii, p. 293; Butler, *ibid*, iv, p. 4; Fairbank, *ibid*, p. 262; Butler, *ibid*, v, p. 231; Davison and Wend., *ibid*, vii, p. 86; Hume, *ibid*, p. 162; Ball, *ibid*, p. 225; Hume and Marsh., Game Birds, 1, p. 59; Hume, Cat. No. 800; Butler, Cat. B. Sind, etc., p. 52; McInroy, Str. Feath., viii, p. 492; Tufnell, *ibid*, ix, p. 201; Heaviside, *ibid*, p. 202; Butler, *ibid*, p. 421; *id.*, Cat. B. S. Bombay, p. 67; Davidson, Str. Feath., x, p. 316; Barnes, B. of Bombay, p. 295; *id*, Jour. B. N. H. Soc., v, p. 334; Laurie, *ibid*, vi, p. 94; Oates in Hume's Nests and Eggs, 2nd. Edit., iii, p. 364; Nurse, Jour. B. N. H. Soc., xiv, p. 172; Major F. J. N. Barton, *ibid*, p. 606; Ogilvie Grant, Cat. B. M., xxii, p. 27.; Oates, Game B. Ind., i, p. 45; LeMess, Land and Water B. of Ind., p. 56; Barnby Smith, Avicultural Mag. 1910, p 313.

Pterocles fasciatus.—Sharpe, Hand-l. i, p. 51; Oates, Cat. Eggs B. M. i, p. 79.

Pterocles quadricinctus.—Jerdon, Madr. Jour. L. S., xii, p. 4; *id*, iii. M. Orni, plo. 10 and 36.

Vernacular names.—Pahari Bhat-Titur, Bhat-ban, Dongar Rowrie (*Hin. N. W. P.*); Palki (*Belgaum*); Handeri (*Southern India*); Kal-Goujal Haki (*Can. Mysore*); Sonda Polanka (*Tamil*).

Description—Adult male.—Forehead white followed by a black band, then by another white one, each band being about 2″ wide; remainder of crown reddish buff spotted with black or deep chocolate brown; hind neck olive-yellow or olive-buff; upper and lower back, upper tail coverts and rectrices a rather chestnut buff, barred with black, the black bars increasing in width and becoming V-shaped on the last, which with a few of their outer tail coverts are tipped yellow buff. Scapulars like the back but more boldly marked, many of the bars being somewhat grey and most of the feathers being broadly tipped with yellow-buff. Wing coverts buff, the innermost being tinted like the nape and gradually changing to an ochreous buff on the outer; a small patch next the scapulars marked in the same way as those feathers. Winglet, primary coverts and primaries dark brown, the last margined paler; inner secondaries like the scapulars, their coverts barred white and slate-colour with deep buff edges and with the margins of the slate bars black. Under aspect of wing a grey brown, inclining to buff near the shoulders. Chin, throat, side of head, fore neck and upper breast ochreous-buff, bordered by a broad, bright chocolate band, this is succeeded by a band of whitish buff and both these bands run right up under the shoulder of the wing to the back; rest of abdomen, flanks, thighs and vent banded deep brown, or chocolate-black and white; below the white breast band the bars are obsolete giving here the appearance in some birds of a definite deep brown or black band; under tail coverts banded buff and black.

"The colours of the soft parts vary somewhat. I have recorded the *feet* as dirty yellow, pale reddish olive, pale dingy brown, pale orange brown; the *irides* as brown, the skin round the eyes as yellowish green, and again bluish yellow; the bill as brown, reddish brown, reddish horny, dingy orange red, and dark orange red." (Hume.)

"Bill red; orbital skin lemon yellow; irides dark brown; feet dull yellow; claws reddish." (Jerdon.)

Wing 6·25″ to 7·25″ averaging 6·7″; bill at front ·49″ to ·58,″ averaging ·52″; tarsus ·88″ to 1·01″ averaging ·95″. As regards wing measurements it should be noted that only four birds out of over 100 measured had a wing exceeding 7″ and only some half a dozen wing of under 6·5″.

"The sexes differ but little in size. From a very large series of measurements taken in the flesh I find that—

"*Males.*—Measure: Length 10·5 to 11·25; expanse 19·75 to 22·5; wing 6·4 to 7·0; tail from vent 3·25 to 3·75; tarsus 0·88 to

1·0; bill from gape 0·58 to 0·7. Weight 6 to 7·5 ozs. (Hume.)

Jerdon gives the weight of the male as from 7 ozs. to 8 ozs.

Variation in the colour of individual adult males consists principally in the depth and tone of the tinting of the upper surface. This in some birds is deeper and more reddish and in other birds paler and more buff. There is also considerable difference in the grey markings on the scapulars, etc., in some there being quite a french, or slate grey, in the centre of the bars, whereas in others the centre of the bar is almost concolourous with the margins.

Adult female.—Whole crown as in the male but the forehead without the black and white bars; nape more yellow buff and with the spots smaller than those on the head; whole remaining upper surface a reddish or chestnut buff, paling to ochreous buff on the rectrices and marked throughout with very deep brown or black bars, those on the tail being broadest; scapulars and innermost secondaries broadly tipped with pale yellow-buff, winglet, primaries, primary coverts and outer secondaries, as in the male, brown; inner secondaries like the back but with broader bars and often with a vinous tint on the outer webs; lores and sides of the head fawn with black striæ; chin and upper throat fawn-buff, immaculate in old birds, finely spotted in young ones; whole lower surface barred buff and deep brown, the buff bars becoming more or less white on the abdomen, where the brown bars deepen to black.

Females of this species vary almost more than the males and the difference in tint on the back is very great, varying from a rich, almost rufous bay, which, however, is very rare, to a pale sandy buff which is very common. The colours of the lower parts vary less, but birds are sometimes met with which have the breast bars almost white, the buff tint being quite faint and irregularly distributed.

The colours of the soft parts do not differ from corresponding parts in the male.

Wing 6·0″ to 6·9″ averaging 6·55″; bill at front ·47″ to ·56″ averaging ·51″; tarsus ·85″ to ·98″ with an average of about ·94″.

Hume gives the measurements as follows:—"Length 10 to 10·5; expanse 19·5 to 20·5; tail from vent 3·25 to 3·75; tarsus 0·88 to 1·0; bill from gape 0·55 to 0·6; weight 6·38 to 6·75 ozs."

It will be seen, therefore, that Hume's measurements practically agree with mine and show that, age for age, males are a trifle bigger and heavier than females.

Young male.—The young bird acquires the plumage of the adult first on the wings and upper plumage, but this is much broken up with dark brown vermiculations; the tips of the quills and sometimes the inner portions of the inner webs are marked with pale buff vermiculations and the plumage of the upper back, hind neck and head are more like that of the female but these parts also are everywhere profusely vermiculated. On the under surface the deep breast band is either obsolete or indefinite and much mixed with buff. From the breast downwards the lower surface of the body is banded black and white as in the adult bird, but the bars are narrower and not so perfect. The white forehead seems to be one of the last parts of the adult plumage to be acquired.

At a still earlier age, the whole of the back is vermiculated buff and black and the general colour varies through as wide a range of tints as in the adult. On the under parts the breast and abdomen are still more weakly barred than in the stage just described and the bars on the centre of the abdomen and about the vent often merge into a blurred patch of black or dark brown.

" Young females resemble young males, but the under parts are like those of the adult female. " (Ogilvie Grant.)

The nestling is said to be covered with a uniform earth-brown down, the same colour as the soil on which the eggs are laid.

Distribution.—The habitat of this beautiful Sand-Grouse is given as follows by Blanford : " Peculiar to India and resident. Found in suitable places throughout the greater part of the Peninsular, but not on the Malabar or Bombay Coast, nor in the Forest Region North of the Godaveri and East of Raipor, Mandla, etc., nor in the low grounds of the Carnatic. This Sand-Grouse is fouund throughout the Deccan and the Central Provinces and as far South as Mysore, and is common in parts of Guzerat, Cutch, Rajputana, the N. W. Provinces and amongst the Siwalik Hills of the N. W. Punjab, but does not occur West of the Indus, nor on the Gangetic alluvium."

Its range has now to be carried considerably further East and also North-west across the Indus. In the Santhal Parganas I shot two birds out of a small flock, which for some days frequented some ravines close to the Birbhum Road between Nya Doomka and Suri. I have records of its appearance both in Ranchi and Hazaribagh and in Gya, further East than recorded by Hume, in the plains at the foot of the Ranga Hills. All these places are very dry and stony and are situated in amongst, or near hills, which are broken up with ravines and dry water-courses, but at the same time have a growth of jungle, scrub for the most part, but in others stunted tree and short coarse grass. None of the districts mentioned come within the area described by Hume as the " low, rich, unbroken alluvial plains in.................. the whole of the Lower Bengal and Assam."

As regards the N.-W. Major F. J. K. Barton records in the Journal that *P. fasciatus* has been shot every year, almost since 1895, at Rustom, some 20 miles from Mardan in the Buner foot hills. He says : " Painted Sand-Grouse are found near Rustom in low stony hills with a fair quantity of jungle growing on them. They are generally put up in pairs or small flocks. The natives say they are always there, but that the numbers vary, some years there being more than others."

It has also been procured near the Orakzai, about half way between Bannu and Peshawar, and it is probable it will be found all along the foot of these hills. Mr. H. G. O. Bridgeman, in writing to me, says that they are comparatively common on the "Kala Chitta and neighbouring hills just South of Campbellpore during October and............it is difficult to believe that they never cross the River Indus, as opposite to where the Kala Chitta Hills meet this river, exactly similar ground is almost within stone's throw."

The habits of the Painted Sand-Grouse are very different from those of the Common Sand-Grouse, our one other Indian resident which can compare with it in numbers. It is essential for this bird that it should have a certain amount of cover, and where this is absent, so will the bird be. Its favourite resorts are low rocky hills and the country immediately surrounding them, but the soil must be comparatively dry and the cover must be neither too dense nor too sparse. Tree and evergreen jungle it seldom enters and it prefers low scrub jungle, especially such as is rather sparse and scattered and which is broken up by numerous stoney ravines and dry, or nearly dry, water-courses.

They are seldom found in large flocks, more often in pairs than anything else, and, according to Hume, seldom in packs of over ten, which is the largest pack he has personally seen.

Mr. Bridgeman writes that he always found the birds in small parties of four or five, that is to say, in small family parties consisting of the parent birds and their last brood.

Occasionally, however, it does collect in much larger flocks and some of my correspondents mention packs of over one hundred. Mr. E. Phythian Adams says: "When marching through the Berars, at one of our halting places, we put up about 200 from a scrub covered hill. At other times I have only seen a few together."

So, also, Nurse in this Journal (*in loc cit*) records: "It is usually found only in small flocks, but this morning when shooting over some ravines covered with a little grass and a few bushes, I came across a large number, not less than two or three hundred. They were chiefly in flocks of from two to six, but there were several packs of ten or a dozen, and one flock of sixty or eighty birds. They were very wary and I seldom succeeded in getting within thirty yards of them. However, I managed to shoot twenty one, which is the largest number of this species I have ever killed in a day, chiefly by standing behind a bush and having them driven towards me. I could certainly have got more if I had cared to stay later, as they did not fly to any great distance and could generally be marked down."

Capt. A. H. Mosse sends me a very interesting account of this Sand-Grouse's habits, which shows well the many ways in which it differs from the majority of its relatives. Captain Mosse writes:

"It is common enough in all the less cultivated and more jungly parts of Guzerat, preferring more or less hilly country where the jungle is not too dense, and rarely, if ever, resorting to the open plains beloved of the Common Sand-Grouse. During the monsoon months, however, it does sometimes visit the more civilized parts, but only where there are trees, for instance, I have seen it at Baroda in the month of June.

"It does not ordinarily collect in large numbers like the Common Sand-Grouse and, as far as I can recollect, I have never seen more than seven or eight together, except when the flocks meet at a common drinking place. It differs, too, from the common species, and from the Imperial Sand-Grouse in its drinking habits. These two, as is well-known, drink in the morning after the sun has become hot and sometimes also, at least in the case of *P. exustus*, a couple of hours or so before sunset. *P. fasciatus*, on the contrary, always drinks at dusk, never in my experience before the sun is well below the horizon.

"It is a much more silent bird than *P. exustus* and, unlike the latter, it flies always within a few feet of the ground, so that it rarely shows up against the sky line and is not too easy a bird to shoot in the fading twilight. It does not, however, take as much killing as its notoriously tough relative, falling when hit, to smaller shot at greater distance.

"On one occasion, when I was sitting up for a panther near a pool in a river bed, in the North of the Mahi Kantha Agency, the Painted Sand-Grouse kept coming to drink in the gathering dusk in small parties until there were, at a rough estimate, about 150 birds collected at the water's edge in a patch of some thirty yards in length. This is the only time I have seen so large a number together, and quite a noise they made with their chattering, both as they arrived and on the ground before drinking. The single note, softer and lower than that of the Common Sand-Grouse, I have never heard except at dusk. When they alight on the ground they drop very suddenly and then squat like a nightjar.

"Although I have never personally seen this Grouse drink except at dusk, it is not impossible that, in the hot weather, it may also sometimes drink at dawn before the sun is up. I have more than once seen it on the wing at this time of the day."

Hume mentions the fact of their drinking in the morning and Blanford also says that they fly to water before sunrise and after sunset, but neither of these writers give any further details as to their watering in the early dawn.

Mr. Adams, as quoted by Hume, gives a rather similar account of the visit of these birds to a small pond in an Acacia grove, and in this says that his attention was first drawn to the birds by the "peculiar *cluck, cluck* which *fasciatus* makes when rising," he also adds that on alighting the birds "lay perfectly still for two or three seconds and then all of them commenced a rapid run down to the water."

Mr. Adams also states that "the Painted Sand-Grouse entirely leave the forests and jungle in the early part of the rainy season and then live in the open country, all through the rains, exactly as *P. exustus* does."

Although distributed over a very wide area and comparatively common in many parts of it, nowhere does this bird appear in the enormous numbers that *P. arenarius*, *P. exustus* and *P. alchata* do, consequently the huge bags which are sometimes made of these Sand-Grouse are never equalled by the bags made of *P. fasciatus*. Hume writes: "Where they are abundant they afford extremely pretty shooting, and 20 to 25 brace is by no means an out-of-the-way bag for two good guns. Even though at first flushed in parties of 7 to 10, they break up into pairs and singles after the first shot, and lie well. I have never seen them wild or rise at greater distances than 30 or at most 40 yards, and very often they whir up within a few feet. They rise with a chuckling chirp, fly low, and soon alight again, however, running a considerable distance after they have alighted. They run extremely well, compared with other Sand-Grouse, as I have repeatedly noticed when standing above whilst others were shooting below. For a moment I have often mistaken them for Grey Partridges.

"Although their flight is strong and tolerably fast, they offer an easy shot, and can be dropped with charges, and at distances that would afford little prospects of a kill in the case of *exustus*.

"Their plumage is very delicate, and half the feathers of the back and breast are often knocked out by the fall when they are shot. The aural orifices are very large, and being only partially covered with feathers of which the webs are very far apart, are conspicuous; but the birds do not appear to hear particularly well, or if they do, they are very tame or stupid, for they continually rise at one's feet, and if much disturbed lie so close that they are almost as hard to raise as Button Quail.

"Their crepuscular habits are undoubted, though I cannot say that I myself have often noticed them after dusk."

Nearly all sportsmen agree with Hume in considering that they are far less wild and smart than most Sand-Grouse and that they are also easier to kill. Col. Fenton remarks, *in epistola*, "When flushed they do not fly very far before pitching again. By marking them down and flushing them again one can go on shooting at them over and over again, until one or all the birds in a covey are bagged." Lieut. Pythian Adams says just the same and Jerdon, Thompson, Adams and other writers all give similar accounts.

Mr. Bridgeman points out that these Grouse when flying keep much closer together than the other species do, so that frequently more than one bird gets knocked over by the same shot and that he himself has once dropped three birds out of four and several times two out of four and this without in any way being guilty of "browning."

The Painted Sand-Grouse appears to be almost exclusively a vegetarian and the crops of those examined by Hume and others have so far contained practically nothing but grain and seeds of various kinds. They seem, also, to keep very much to a hard diet and only one or two of my correspondents mention their indulging in green food, though they undoubtedly do eat such sometimes. They certainly eat White-ants—but squirrels even, as well as doves and similar vegetarian eaters will all tackle and swallow them with greediness—and one correspondent says that he found them feeding on ants. Probably they eat small insects fairly regularly as they come across them, though they may not go out of their way to hunt for them when grain is handy.

Captain Heaviside records a curious habit he observed in these birds in the Nerbudda Valley where he noticed them "in the evenings on the cart tracks, where they were probably dusting themselves as there is no grain traffic on these roads."

These Sand-Grouse suffer to a certain extent from snarers and bird catchers, but owing to their habits and to the fact of their not going about in large flocks, they do not fall victims to anything like the extent that *P. arenarius* and *P. exustus* do. Adams says that "Large numbers of the Painted Grouse are taken during the rainy season by bird catchers, who approaching under cover of a screen made of green leaves and twigs, drop a circular net, suspended to a hoop and held out horizontally at the end of a long bamboo, over the birds, which as a rule never seem to suspect that danger is at hand."

The most common means adopted to snare them is by nooses laid at the regular drinking places, in the same way that all the other Sand-Grouse are taken.

An excellent account of these birds in captivity is given by Mr. Barnby Smith in the Avicultural Magazine who writes: "The habits of the Painted Sand-Grouse were from the first strikingly different from those of the Pintail. When the latter were frightened their instinct was to fly, whereas the Painted Sand-Grouse crouched all together in a corner as though it was their nature to seek cover; although as a fact, there was no cover there.

"I accordingly provided them with another enclosure very similar to the first, except that nearly all the floor space was covered with tussocks of grass, small box bushes, dwarf juniper, etc., of course with sandy spaces at intervals. I found the birds always loved to lie in the sun near a tussock of grass, and would be seen to have moved their position several times a day so as to get full sunshine. This surprised me, as they are said to be crepuscular and nocturnal in habit. Their large staring black eyes would quite give one this impression. Whatever they do by night their habits by day are most unexpected, and they justify their common name of "painted" in an extraordinary manner, for they might as well be merely painted birds as far as any movement can be observed in progress. One might go to look at them half a dozen times a day for weeks without seeing them making any movement. The seed put down vanishes, and the birds keep a good gloss on their feathers and appear to be in excellent health. Very occasionally one may be seen moving, but the same instant the bird will catch sight of you and draw in its head and remain squatting motionless, however long you remain to watch. If approached within a couple of feet, however, the bird will attempt to fly, with its wild alarm note of "Yek-yek-yek," and land behind another tuft of grass. After one attempt to fly, if again approached, it will permit itself to be handled. It is said that bird-catchers in India take these Sand-Grouse by approaching them under cover of leaves and dropping a net suspended at the end of a bamboo. Having seen the birds themselves I can readily imagine the possibility of such a method of capture.

"To make up for their uninteresting habits, it must be conceded, however, that the Indian Painted Sand-Grouse have most exquisitely marked plumage, the markings on the cock especially being most striking. Even in rough grass they are very difficult to see at short distance, but our English grass is too green to hide them perfectly. I should imagine that in their native haunts they will form a perfect example of obliterative coloration."

Nidification.

Wherever the Painted Sand-Grouse occurs it is a resident and breeds and young birds or eggs have been taken from all parts of the tract of country it frequents.

The principal breeding season is probably April to early June, but eggs have been taken at all times of the year, and it is difficult to say with any certainty that these are the favourite laying months. It is also probable that very few breed during the height of the rainy season, *i.e.*, from July to the early part of October. Amongst others who have reported the time eggs have been taken are the following:—

Pythian-Adam, Davidson	January.
Butler, Col. R. Bingham	February.
Mosse, Davidson, Wenden	March.
Hume, Adam, Pythian-Adams, Bulkley	April.
Nunn, Hume, Davidson, Bulkley, C. T. Bingham	May.
Barnes, Felton	June.
Thompson, Davidson	November.
Pythian-Adams	December

As one would expect from its habits the Painted Sand-Grouse deposits its eggs, as a rule, in ravines, broken ground, etc., where there is certain amount of cover and, in the Central Provinces actually in forest land. As a rule it makes no nest at all, though a few odd pieces of grass may, perchance, collect in the hollow it scratches out in the earth before depositing its eggs. Sometimes, however, it does make some pretence of a nest, collecting a few bents and grasses and fashioning these, by pressure only, into a hollow cup, fitting the depression already made in the earth. Mr. R. Thompson also describes a nest which would appear to have been yet a further advance in architectural skill. "The nest contained three eggs, of which one unfortunately got broken. It was placed on the ground on a slight rise; neatly and well put together saucer like, made of dried grass, bits of dried leaves of bamboo and other plants. The soil was sandy, with a thin forest growing on it, and the nest was placed under the shade of a small tree. There was no cover in the immediate vicinity of the nest; in fact, for three or four yards all round there was nothing but short thin grass. I accidentally arrived at the spot, and whilst talking to a friend, the female bird got up close at our feet, and I saw the nest immediately." (Hume.)

Ordinarily, however, it makes no nest at all and nearly all observers write to this effect. Capt. Mosse gives me an interesting account of some young birds found by him. He writes: "I have only once come across a nest. This was on the 14th March 1904, in Kathiawar. I was at the time riding through a Bastard Teak jungle and dismounting to investigate the cause of a slight temporary lameness of my pony, caught sight of a pair of bright eyes fixed upon me a few feet away. The owner of the bright eyes being approached still nearer, rose and shewed herself to be a Painted Sand-Grouse. The nest which was merely a slight depression, unlined, contained two young ones a few days old. They were quaint little objects, which flattened themselves down as close to the ground as possible, and they had a peculiarly flattened out shape which enabled them the better to do so. Their covering was of a peculiar flaky character, neither down nor feathers, but something between the two, and their colour was a uniform brown, the exact shade of the surrounding earth."

The normal number of eggs in a clutch is undoubtedly three, though very often two only are laid and very rarely four may be found; such a clutch having been taken by Mr. R. M. Adam. They are in shape elliptical, both ends being equal, as is the case with the eggs of all Sand-Grouse, and they are much the same in size as those of the Common Sand-Grouse (*P. exustus*) but average a shade longer and a trifle less broad. Hume thus describes the large series which have passed through his hands. "As a body they are very regular, obtuse-ended, cylindrical ellipsoids, the shell very smooth and glossy, the ground colour a delicate pale salmon pink, with a good many somewhat widely scattered specks and tiny streaks of brownish red, very generally much more numerous towards one or other end, and with a good many small pale inky purple spots and clouds almost exclusively confined to that end where the markings are most numerous.

"Specimens are occasionally met with in which the markings are very sparse, and I have one specimen in which they are absolutely and entirely wanting.

"Not unfrequently the markings form a pretty perfect zone towards one end, and here and there an egg is met with exhibiting six or eight large deep brownish-red blotches. Pale pinky white, and somewhat buffy stone-colour grounds are also met with.

"Dr. Jerdon remarks: 'I have had the eggs brought me, very cylindrical in form, of a dull earthy green with a few dusky spots; but these most assuredly were eggs of *P. exustus* and not of our present species *fasciatus.*'

"In length the eggs vary from 1·3 to 1·62, and in breadth from 0·93 to 1·05; but the average of forty eggs is 1·42 by 0·98."

These figures in millimetres are, roughly, 33 to 40, 23·5 to 27 and 36 by 25 mm.

In my own collection I have but a poor series of these eggs, but they all agree with Hume's eggs except one pair which have the ground colour a pale dull sea green with a few faded grey and brown blotches and spots sparsely but evenly distributed over the whole surface. These eggs were taken by a good sportsman who knew both the Painted and the Common Sand-Grouse well and I have no reason to doubt their identification, though I cannot guarantee it. Jerdon, notoriously, cared little for eggs and was constantly incorrect in this particular, so little reliance can be placed on the identification of his eggs referred to by Hume above. Nor do my eggs agree with Jerdon's, which seem to have been coloured much like those of *exustus*, whereas the eggs in my collection are very pale and weakly coloured, far more so than any I have seen of that bird.

The season during which the Painted Sand-Grouse should be protected might be taken as from the 1st April to 1st October, by which latter date the great majority of young would be well able to take care of themselves.

The descriptions of the adult male and female given in this paper were taken from the birds from which the artist painted the plates and they depict average well coloured adult birds, but, as I have already mentioned, there is a considerable range of colouration in this as in most Sand-Grouse, and this must always be born in mind by the sportsman and collector when identifying his birds.

A STUDY OF EMOTIONAL EXPRESSION IN FELIS PARDUS.

BY

R. W. G. Hingston, I. M. S.

(*With Plates A and B.*)

As we ascend the animal scale from that stage at which the nervous system has become so concentrated and elaborated as to be capable of weaving the external bodily stimuli into an emotionary sensation, we find that the corporal changes by which that emotion is made manifest have become more differentiated and more complex. Although when the surroundings are unfavourable or possibly directly dangerous, the tiny amœba may check its creeping motion, the coelenterate may retract its tentacles, the mollusc may firmly close its shell or the crustacean hastily scramble away, yet such movements must be considered as of direct service to the creature, as endeavours on its part to shield the body from the source of danger and not as external evidence that any emotion, such as fear of the danger or anger towards the object producing the danger, has been experienced by those minute atoms of living tissue which go to compose its nervous system.

But when we consider those animals higher in the scale of Nature and which, from the greater development of their nervous apparatus, might be expected to possess mental faculties higher than those necessary to protect them from some immediate danger; we find that their internal emotions are expressed in such a manner as to make it difficult for us to determine what actual service those expressions may really be. Thus that inoffensive and harmless little snake the Buff-striped Keelback, when irritated, is described as erecting itself, flattening its forebody and distending itself until it brings into view its blue or vermilion colourations. The painted snipe, when slightly alarmed, is said to raise the wing furthest from the intruder; if pressed this wing is fully expanded, while in desperation the bird faces its adversary with both wings and tail spread so that their beautiful spotted markings are fully shown. Everyone has seen the domestic hen cackling with pride over the egg which it has laid or the domestic cock crowing with triumph over his defeated antagonist, yet few would attempt to explain why such sounds should have been evolved or what benefit they are to the creatures which make them or would prefer to give any more satisfactory explanation than that they are the outward manifestations of the internal emotions which at that moment excite the animal.

But in mammals the outward expression of emotional disturbances has reached a high pitch of differentiation. The horse forcibly

PLATE A.

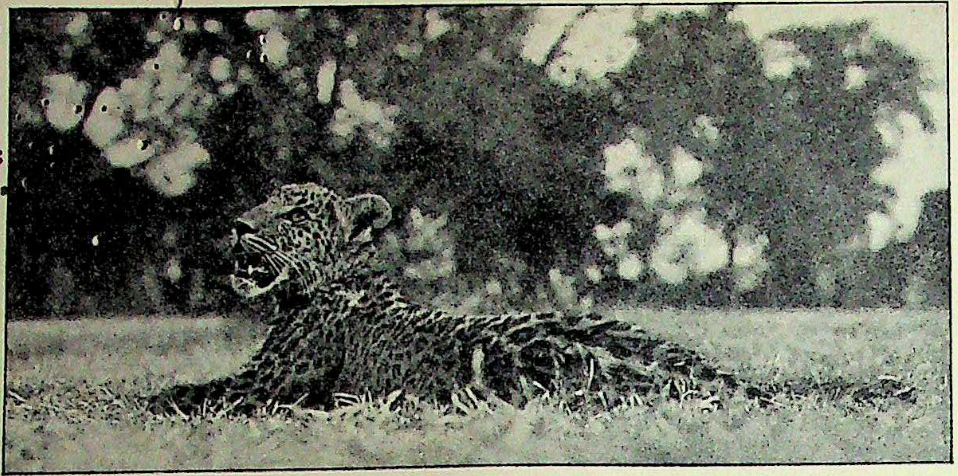


Fig. 1. Interested Contentment.

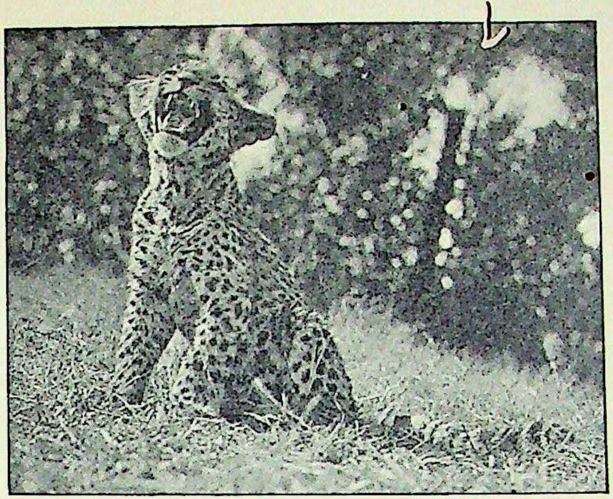
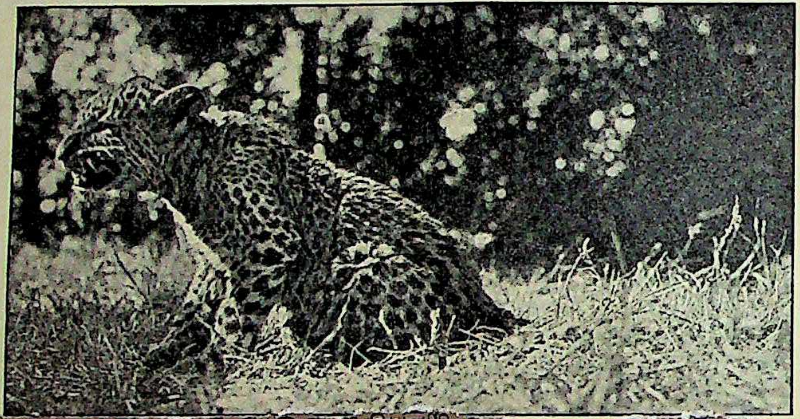
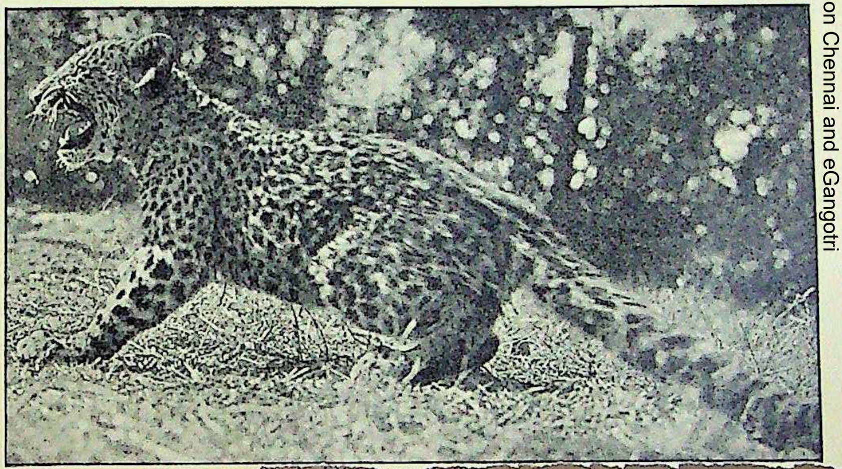


Fig. 4. Distress.





throws back his ears and presses them firmly against his head when he is alarmed. The dog wags its tail and throws its body into flexuous movements when it is affectionate. The cat raises its upper lip, exposes its canine teeth, retracts its ears, stiffens its body and forcibly spits and snarls when it is angry; and in man the emotions are so highly developed and expressed with such distinctiveness that his temper, cunning, his strength of will, his qualities of hatred and of love, his greed, sensuousness, vanity and many other emotions may be portrayed even on his apparently placid countenance.

We cannot expect to see those higher emotions such as shame, surprise, disgust, contempt delineated in the features or attitude of any wild mammal we attempt to study, though they can be discerned in some of the higher ones; and, undoubtedly, in a simple and elemental condition occur in all. But we can and should be able to detect internal evidence of those emotions; such as fear, anger, rage, attention, distress, eagerness and affection, which are so much more gross and simple in character and which play so prominent a part in every stage of the animal's life. From the point of view of emotional expression, the Felidæ form an interesting group, and I have endeavoured to obtain records of *Felis pardus* while experiencing those emotions which are outwardly most distinctive and most capable of recognition.

CONTENTMENT (Fig. 1. Plate *A.—Interested Contentment*).

In the contented and restful state when, after a satisfying meal, the animal lies partly curled upon the ground and the body and mind are calm and quiet or when the mental faculties are in complete abeyance during sleep; there is no rigidity of trunk and limbs, no twitching of muscles or changes in facial expression: the whole animal is limp and supple, its voluntary musculature is in a condition of physiological rest in complete unison with the calm and inactivity of its mind. Occasionally while coiled in this contended state the sight of some passing object may excite the interest of the animal. It raises its head, opens wide its eyes and looks steadfastly towards the object producing this mild excitement; the lower jaw drops and the mouth opens but not in anger; the whole countenance alters and the blank expressionless facies which characterised the animal in its state of pure contentment is changed instantaneously to one of interested intelligence.

FEAR (Fig. 2. Plate *A.—Fear*).

Fear in a wild animal must be frequently associated with anger and perhaps preceded occasionally by astonishment, though the latter would be difficult, if not impossible, to detect. It does seem possible, however, to obtain the expression of fear distinct from that of anger, if the object causing the fear is so powerful as to overawe the animal to such a degree as to prevent it from displaying its anger.

Felis pardus when enduring the emotion of fear produced in such a manner, lowers itself into a crouching posture and throws its ears well back. Both these movements tend to lessen the apparent bulk of the animal and as many of the lower creatures in such conditions of danger, as would create the sensation of fear in the higher ones, do diminish markedly the volume of their bodies and by such diminution obtain definite protection; it is probable that these movements are instinctive tendencies inherited throughout a long ancestry, but which now display little, if any, serviceable manifestation.

The head during fear is often turned in the opposite direction to that from which the danger is expected to arrive. The eyes are partially closed, and tightly so if the fear amounts to terror. The nostrils are pinched so as to give the face a characteristic expression. It is a natural instinct in the higher animals to turn away the face if any special injury is directed towards it and to close the eyes either partially or completely and contract the nasal orifices in order to give protection to the delicate organs contained within, and this instinct seems to be so highly developed and so easily called into action as to occur in general states of fear, even when the danger is not specially directed to the sensitive organs of sight and smell. The limbs and tail are held stiff and the body loses its great muscular laxity. The corners of the mouth are raised, the upper lip elevated, the lower jaw depressed, the mouth is partially opened and the canine teeth displayed. The general facial expression is one of fierceness, and when a wild carnivorous animal is in fear or terror it must undoubtedly be fierce.

The domestic cat when terrified has been described as arching its back and erecting the hair over the whole body, especially on the tail, and as raising the basal portion of the tail upright and bending the terminal extremity to one side. I have never noticed this attitude in *Felis pardus*, nor by experiment have I been able to obtain anything resembling it; and it is possible that owing to the great strength of this animal it would not, in its native haunts, experience fear to any great extent, and would therefore not have the emotion so highly developed and exhibited in a manner exactly similar to that seen in the weaker and domesticated creatures of its kind.

ANGER, RAGE (Fig. 3. Plate *A.—Anger*).

Anger and rage, so frequently associated with fear, are expressed in a very similar manner. The body again crouches and, if the animal is savage, may be lowered completely to the ground. The trunk and limbs are rigid, the claws excerted and the tail usually stiff, though it may be curled from side to side. These are characteristics of an animal about to struggle for its prey. The crouching and rigidity maintain every muscle tense and ready instantaneously for the spring. The claws are projected for the fatal blow. Possibly no cause excites the anger of a carnivorous animal so intensely and so frequently as the prospect of a coming battle and consequently those characteristics, which are of direct service to an enraged animal about to fight, have become so engrained into its nature as to be instinctively associated with its anger under all conditions, even when there is no suggestion of a fight. The rigidity of the tail is due to the muscles of that organ acting in harmonious contraction with those of the rest of the body, and the occasional curling motion may be an involuntary liberation of that great excess of muscular energy, which must be effervescing through its bodily system.

The angles of the mouth are elevated, the nostrils drawn together, but the whole face appears less contracted and pinched than when the animal is expressing true fear. The canine teeth are displayed in an open mouth and when the anger amounts to rage the whole row of teeth becomes clearly seen. The face is directed towards the object which excites the anger and the animal hisses or emits a deep gutteral snarl. These marked changes of facial expression and utterance of sound give to the animal a fierce and savage appearance, and are therefore of service to it by causing it to strike terror into the mind of the creature against which its anger is directed. I have never seen the hair erected during a state of rage, nor could I be certain that distinct hair movements ever occurred or were definitely associated with any emotion.

When the animal is enduring displeasure, but not amounting to anger, the above expressions are made manifest to a slight degree, but when the anger amounts to rage or savagery they are pronounced in a more exaggerated manner.

Although on analysis the emotions of fear and anger seem to be very similarly expressed, yet a comparison of the illustrations immediately shows that in the former the animal appears cowed into submission and ready to retreat from rather than advance towards its enemy, while in the latter he appears to be full of anger and spoiling for the fight.

Distress (Fig. 4. Plate *A.—Distress*).

Pain, though a most powerful sensation, can scarcely be considered as an emotion, its presence, however, gives rise to forcible emotionery outbursts so tangibly associated with those of fear and rage as to be incapable of separate recognition. An animal in pain must be in distress and this certainly is an emotion. It must also be terrified or enraged, and it is therefore not possible to describe any series of characteristics solely distinctive of a pained or distressed animal. A leopard in pain resembles almost identically a leopard in a state of anger, but the face displays a distressful appearance, and it is difficult to determine what individual muscles are brought into play in the production of it. The mouth is sometimes widely opened and the body may conform to almost any attitude.

EAGERNESS (Fig. 5. Plate *B.—Eagerness*).

When *Felis pardus* feels intensely eager as when it is stealthily creeping towards its prey or crouching low with the intention of springing on it, the attitude and expression again become characteristic. It is not reasonable to infer that under these conditions pure eagerness is alone manifest. It would be a matter of great difficulty to conclude that, when an animal is about to seize another for food and is probably anticipating a battle before that food is obtained, no other emotion, such as hatred of, or anger towards, the prey or subdued excitement at the prospect of an expected struggle or fear as to the consequences of that struggle is not at the same moment influencing the mind of the animal and converting what at first sight appears a simple emotion into one of extreme complexity. Intense eagerness, however, must be a very strong, if not the prevailing emotion under these conditions. If the other emotions of fear, anger, hatred or excitement were expressed in their unadulterated state, the sudden muscular movements and alterations in countenance associated with them would be in direct antagonism to the stealthy motion of the animal and fatal to the success of the object in view. We may conclude that if they are present, and no one can say that they are not present, they must be kept in a state of suppression or subdual by a higher and more powerful nervous control.

When intensely eager *Felis pardus* lowers its body completely to the ground. The hind limbs are flexed beneath the trunk ready to be instantaneously extended when the animal springs. The fore limbs are stretched forwards and the head which is lowered on to them is so fixed that the jaws rest on the dorsal surface of the feet and the chin is firmly pressed on the ground between them. By this depression of the head the apparent bulk of the animal is diminished and this gives him a greater opportunity of reaching his prey. The tail is curled, the ears are tilted forwards and the aural aperture enlarged to catch the slightest sound. The eyes are fixed and staring to note the gentlest movement. The mouth is tightly shut so that the teeth are completely covered. There is no twitching of the muscles or alterations in the countenance. The hair is occasionally erected but not often. No vocal sounds are emitted. The nostrils are slightly dilated and the whole body is absolutely motionless and in a state of rigid muscular tension, while the face expresses that earnest determination which at times must be so necessary for the successful accomplishment of the animal's desires.

Intense eagerness is also expressed when the animal is in motion as when it is endeavouring to discover the whereabouts of its food or is creeping with stealth towards another animal. The general attitude is precisely similar to that of an animal about to spring, but the head and body are lowered less completely to the ground and

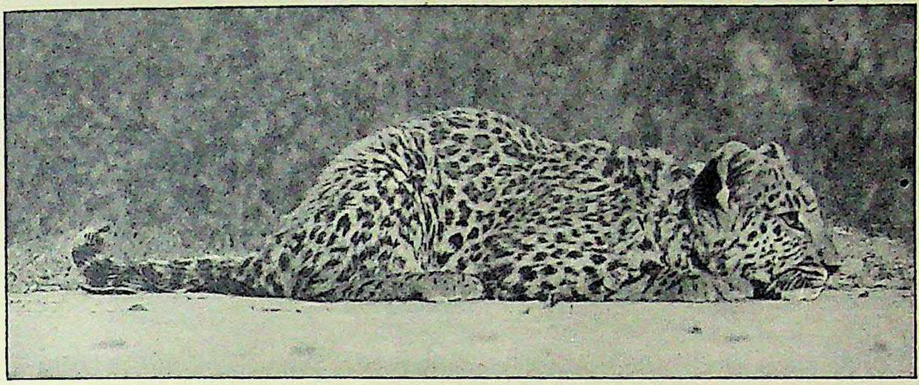


Fig. 5. Eagerness.

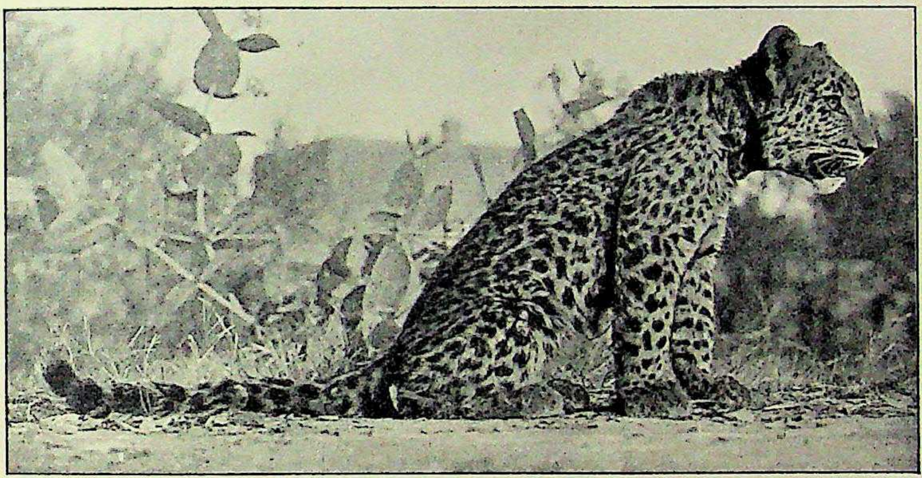


Fig. 6. Attention.

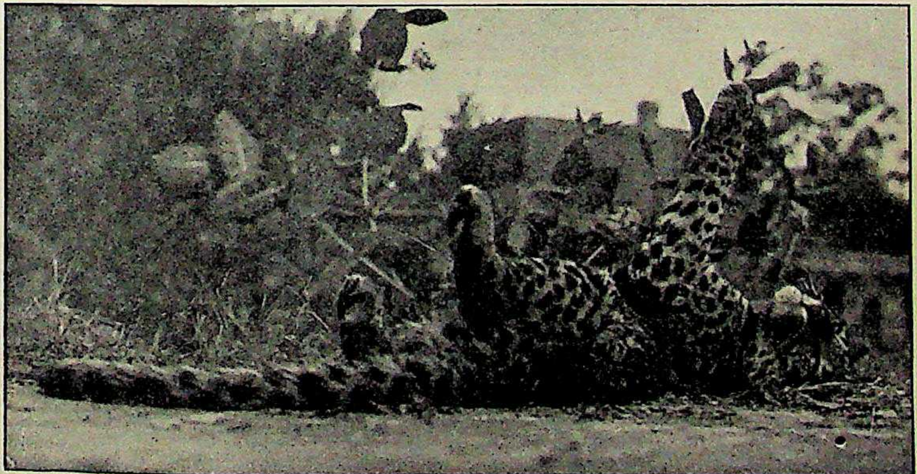


Fig. 7. Playfulness.

EMOTIONAL EXPRESSION IN *FELIS PARDUS*.

the animal moves forward with extreme quietness. When the sense of smell is brought into action in association with this movement, the nostrils are dilated, the nose depressed to the ground and the animal sniffs with vigour as it moves silently and rapidly from place to place.

ATTENTION (Fig. 6. Plate *B.—Attention*).

When *Felis pardus* distinguishes in the distance an object, the nature of which it does not clearly recognise or hears a sound which it does not understand, the attitude which I have designated as "attention" is immediately assumed.

It may be considered with much truth that the two emotions of attention and curiosity so frequently associated and exercised in combination would not in the lower animals be sufficiently differentiated as to cause the gestures resulting from the influence of those emotions to be displayed in a different and individually characteristic manner. If the animal is lying in a calm and contented state and suddenly, on the hearing of an unusual sound, springs into the attentive posture, it is difficult to determine, with any degree of accuracy, whether the fixed position of body and the intent expression of the facies then assumed is due to a sense of curiosity manifested by a desire to discern the cause and nature of the sound or by a less complex sense of attention without any desire to make such an analysis.

In the attitude of attention the trunk is raised, so that the body is supported sometimes on the two front limbs and sometimes on all four. By this movement the animal's range of vision is greatly increased. The ears are directed forwards and the eyes widely opened. The mouth may be partially open or closed. The head is usually craned a little forwards and occasionally moved from side to side as though it was endeavouring to obtain in different directions a further explanation as to the cause of this excitement. There is no puckering of the features, no tightening of the angle of the mouth or exposure of the teeth. The hair over the shoulders may be slightly ruffled, but not markedly erected. The intent appearance of the countenance, produced mainly by the fixed and staring expression of the eyes, can scarcely be mistaken.

AFFECTION (Fig. 7. Plate *B.—Playfulness*).

The emotions of affection and love are diametrically opposed to those of anger and hatred, and are associated with external expressions equally distinct in their antithesis.

When *Felis pardus* is affectionate, the body is always limp and supple and the face calm and placid. There is no pricking of the ears or pinching of the nostrils. The teeth may be exposed by a uniform opening of the whole mouth, but never by a raising of its angle or by a wrinkling of the upper lip or associated with any muscular tension which might suggest a snarl. The eyes are dilated and express docility. The claws are ensheathed. In this happy temperament *Felis pardus* resembles the domestic cat in its desire to lick or rub its head and trunk against the object towards which it is displaying its affection and to pat or pound it gently with the soft pads of its extended feet. This latter peculiar habit is most probably in origin the same as that pounding which young kittens may be seen to perform on the teats of their mother when they are suckling and at that time they are no doubt affectionate.

When we contrast the expression of the emotions of affection and anger it is clearly evident that they are in direct opposition to each other. Compare the supple trunk, the elevated ears, the dilated eyes, the ensheathed claws and the happy countenance of affection, with the rigid body, the depressed ears, the half closed eyes, the projecting claws and the fierce and pinched expression of anger. All these characteristics associated with anger are, to a greater or less extent, of some service to the animal if it be considered that its anger is directed towards some other animal which it is about to attack; and in its native haunts there can be no other cause which so frequently and acutely excites its anger.

But on the other hand it does not seem possible to detect any serviceable asset in the opposed expressions associated with affection. They can only be explained on the Principle of Antithesis which states that any action or series of actions which have for long periods of time been directly associated with any sensation or emotion will be immediately suppressed under emotions of a directly opposing nature and that an antagonistic set of muscles will be brought into play so as to produce an opposite action or series of actions, though they may be of no use.

During play the animal may assume almost any posture. It may roll on its back on the ground and wave its paws in the air and with its claws completely ensheathed endeavour to grasp the object with which it is playing. It may spring towards its playmate and leap upon him. It may seize him between its teeth, but will never injure him or express in its attitude or countenance any desire to do so.

Just as man has his hates and loves, so have the lower animals their hates and loves also. Wonderful is the mind of man and great is the gulf which divides it from that of the very highest of the brutes, yet every impulse of its will, every sensation it receives, every emotion it excites is, in a fundamental manner, experienced in the minds of those very brutes whose ignorance we so despise.

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NOTES ON A COLLECTING TOUR AT RAMTEK, C. P.

BY

R. J. D. GRAHAM, M.A., B.SC.,

ECONOMIC BOTANIST, C. P.

General.—The following note is the result of a collecting tour made in the first week of September last year. The object with which the tour was undertaken was that of comparing the flora of the transition formations with that of the Deccan trap. So far as the comparison is concerned, the tour was a failure, for with few exceptions both formations showed a more or less common flora. As however no list of Central Provinces plants has been published, I propose to give the list of plants collected at Ramtek. From a botanical point of view the Central Provinces form a particularly interesting area as they furnished the meeting place of the Bombay or Western flora and the Bengal or Eastern flora. Nagpur may practically be taken as the Eastern limit of the Deccan trap and with it of the Deccan flora. Eastwards through Bhandara and Chatisgarh the Bengal flora commences.

Situation.—The town of Ramtek, the headquarters of the tahsil bearing the name, is situated in 21°-24′ N. and 79°-20′ E., 28 miles north-east of Nagpur by road. A mile and a half east of the town is the hill of Ramtek. Crowned with its white temples it forms a conspicuous object rising abruptly 600 feet above the almost level Wainganga plain. The hill itself is about 1,400 feet above sea level.

Topography.—The hill is a detached hog-backed spur forming almost the last link in the chain of hills known as Amnagar Range of Bhandara. On the east the range is continued by the low-lying hillocks of Mansar and Kandri with their famous manganese deposits. Four miles east the Sur river has broken through the range in a narrow gorge. In 1909 this gorge was closed to form the Ramtek Reservoir, giving a spread of water, when full, of nine square miles to the north of the hill. The hill terminates on the west in the form of a horse shoe or V, the inner sides enclosing the Ambala tank near which is a fair sized village. On the south and west sides the hill ends abruptly in lofty natural scarps. No springs were found on the hill sides.

Geology.—The Ramtek Range consists of quartzites often slightly micaceous. The strata are inclined at 50°-55° dipping towards the south. The freshly fractured stone appears red in sunlight doubtless giving rise to the old name for the hill Sinduragiri, "the vermillion mount." The high elevation of the strata accounts for the absence of any springs.

Climate.—Figures for temperature are only available for Nagpur. The maximum recorded during the hot season of March to June is 117·8° F. though as a rule the maximum temperature lies between 110° F.-115° F. During the cold weather months of December and January, the temperature in the day varies between 80° F.-90° F. dropping at night to 52° F. and occasionally in January to 48° F. Ramtek being higher than Nagpur is probably slightly colder.

The average rainfall recorded over the past forty years at Ramtek is 50·29 inches, mostly received from the middle of June to the end of September.

General characters of flora.—The heavy rainfall confined in a short period furnishes the climate essentially suited for woodland. The forest belongs to the monsoon type of the tropics and is leafless during the dry months. Thus *Sterculia urens* is leafless from November to June, *Boswellia serrata* leafless from January or December to June. *Chloroxylon Swietenia* from February, *Wrightia tomentosa* from March to May. *Tectona grandis* is leafless from December to June. The leaf fall is preceded by a severe attack of *Uncihula tectonæ* (Teak mildew) and this probably accounts in part for the early leaf fall. Many trees show xerophyllous adaptations in addition to the periodic leaf fall, *e.g.*, the thick almost fleshy leaves of *Gymnosporia montana*, a plant common throughout the area. The trees are without exception low growing with thick stems and relatively small leaves. In some, *e.g.*, *Zizyphus jujuba*, an umbrella shape is well developed while pinnately or bipinnately compound leaves are extremely common. A noticeable feature is the red colouration in the young leaves of many trees and shrubs especially in *Woodfordia floribunda* and *Combretum valifolium*. A further point of interest is the light position occupied by the young leaves. Practically all hang vertically downwards, exposing only their basal edge to the rays of the mid-day sun. Only when the leaf tissues have matured do the leaves take up a fixed light position.

Special features.—The most notable absentee from the trees on Ramtek were *Acacia arabica*, *Acacia leucophlæa*, *Phœnix sylvestris* and *Mangifera indica*.

The occurrence of the same herbaceous plants in both situations is accounted for by the fact that these plants are more dependent on climate (rainfall) than edaphic (soil) conditions. The most striking group of plants on the hill was perhaps the flame coloured *Cæsalpinia pulcherrima* to the N. E. of the temple and the undergrowth of *Nyctanthes* about three-quarters of the distance to the gorge of the Sur river. The undergrowth was confined to the ridge extending only a short distance on the slopes.

The influence of man is seen on the slopes round the village where the ground is carpeted with *Cassia occidentalis*. Its fetid leaves are avoided by the village cattle. Bamboos (*Dendrocalamus*

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strictus) occur only on the northern slopes. Their survival is probably due to their distance from human habitation, and their disappearance from the inner slopes is very typical of the way in which excessive demand has abolished this species over large areas of Central Provinces forests. The presence of a large number of thorny bushes and small trees is no doubt in part a response to the ecological conditions but must not wholly be attributed to this cause. The villagers in their search for firewood naturally chose the most easily procurable material and avoid those armed with thorns. The seedlings also of these plants escape grazing on account of their thorns.

The absence of grasses in the list is due to the time at which the collection was made and to the late arrival of the rains last year. Only the earliest grasses were in flower and on inner slopes of the hill they were grazed level with the ground.

Anonaceæ.
- *Anona squamosa*, Linn.

Menispermaceæ.
- *Cocculus villosus*, D. C.
- *Cissampelos Pareira*, Linn.

Capparideæ.
- *Cleome monophylla*, Linn.
- *Cleome viscosa*, Linn.

Violaceæ.
- *Ionidium suffruticosum*, Ging.

Bixineæ.
- *Cochlospermum Gossypium*, D. C.

Polygaleæ.
- *Polygala erioptera*, D. C.

Caryophylleæ.
- *Polycarpæa corymbosa*, Lamk.

Portulaceæ.
- *Portulaca oleracea*, Linn.

Malvaceæ.
- *Sida humilis*, Willd.
- *Sida mysorensis*, W. & A.
- *Sida carpinifolia*, Linn.
- *Sida cordifolia*, Linn.
- *Urena sinuata*, Linn.
- *Hibiscus Solandra*, L'Herit.
- *Thespesia lampas*, Dalz. & Gibs.
- *Bombax malabaricum*, D. C.

Sterculiaceæ.
- *Sterculia urens*, Roxb.
- *Helicteres Isora*, Linn.
- *Melochia corchorifolia*, Linn.
- *Waltheria indica*, Linn.

Tiliaceæ.
- *Grewia lævigata*, Vahl.
- *Grewia salvifolia*, Heyne.
- *Triumfetta rhomboidea*, Jacq.
- *Triumfetta rotundifolia*, Lamk.
- *Corchorus trilocularis*, Linn.

Malpighiaceæ.
- *Aspidopterys cordata*, A. Juss.

Geraniaceæ.
- *Biophytum sensitivum*, D. C.
- *Impatiens Balsamina*, Linn.

Rutaceæ.
- *Ægle marmelos*, Corr.

Burseraceæ.
- *Boswellia serrata*, Roxb.

Meliaceæ.
- *Chloroxylon Swietenia*, D. C.

Olacineæ.
- *Olax scandens*, Roxb.

Celastrineæ.
- *Elæodendron glaucum*, Pers.
- *Gymnosporia montania*, Laws.

Rhamneæ.
- *Ventilago calyculata*, Tulasne.
- *Zizyphus jujuba*, Lamk.
- *Zizyphus œnoplia*, Mill.
- *Zizyphus xylopyrus*, Willd.

Ampelideæ.
- *Vitis latofolia*, Roxb.
- *Vitis setosa*, Wall.

Sapindaceæ.
- *Cardiospermum Halicacabum*, Linn.
- *Schleichera trijuga*, Willd.

Anacardiaceæ.
- *Odina Wodier*, Roxb.

Leguminosæ.
- *Crotalaria hirsuta*, Willd.

Indigofera enneaphylla, Linn.
Indigofera hirsuta, Linn.
Indigofera pulchella, Roxb.
Tephrosia tenuis, Wall.
Tephrosia Purpurea, var. *pumila*, Baker.
Tephrosia villosa, Pers.
Zornia diphylla, Pers.
Smithia gemniflora, Roth.
Æschynomene indica, Linn.
Alysicarpus rugosus, var. *styracifolius*, Baker.
Desmodium gangeticum, D. C.
Desmodium latifolium, D. C.
Desmodium rotundifolium, Baker.
Abrus precatorius, Linn.
Erythrina suberosa, Roxb.
Galactia tenuiflora, W. & A.
Butea frondosa, Roxb.
Phaseolus trinervius, Heyne.
Atylosia scarabæoides, Benth.
Dalbergia latifolia, Roxb.
Dalbergia paniculata, Roxb.
Pterocarpus Marsupium, Roxb.
Cæsalpinia pulcherima, Sw.
Cassia Fistula, Linn.
Cassia occidentalis, Linn.
Cassia Tora, Linn.
Cassia absus, Linn.
Cassia pumila, Lamk.
Cassia mimosoides, Linn.
Bauhinia purpurea, Linn.
Mimosa hamata, Willd.
Acacia Catechu, Willd.
Acacia pennata, Willd.
Albizzia procera, Benth.

Combretaceæ.
Terminalia belerica, Roxb.
Anogeissus latifolia, Wall.
Combretum ovalifolium, Roxb.

Lythraceæ.
Woodfordia floribunda, Salisb.
Lagerstræmia parviflora, Roxb.

Onagraceæ.
Ludwigia parviflora, Roxb.

Cucurbitaceæ.
Trichosanthes cucumerina, Linn.
Luffa acutangula, Var. *amara*, Roxb.
Momordica Cymbalaria, Fenzt.
Citrullus Colocynthes, Schard.
Mukia scabrella, Arn.
Zehneria umbellata, Thwaites.

Ficoideæ.
Trianthema monogyna, Linn.
Mollugo Spergula, Linn.
Mollugo stricta, Linn.

Cornaceæ.
Alangium Lamarckii, Thwaites.

Rubiaceæ.
Stephegyne parvifolia, Korth.
Oldenlandia aspera, D.C.
Oldenlandia nudicaulis, Roth.
Gardenia latifolia, Ait.
Hamiltonia suaveolens, Roxb.
Spermacoce stricta, Linn.
Spermacoce hispida, Linn.

Compositæ.
Elephantopus Scaber, Linn.
Pulicaria angustifolia, D. C.
Eclipta alba, Hassk.
Blainvillea latifolia, D. C.
Bidens pilosa, Linn.
Chrysanthellum indicum, D. C.
Tridax procumbens, Linn.
Emelia sonchifolia, D. C.

Companulaceæ.
Lobelia trigona, Roxb.

Ebenaceæ.
Diospyros montana, Roxb.
Diospyros tomentosa, Roxb.

Oleaceæ.
Jasminum angustifolium, Vahl.
Nyctanthes Arbor-tristis, Linn.

Apocynaceæ.
Vinca pusilla, Murr.
Holarrhena antidysenterica, Wall.
Wrightia tomentosa, Roem and Schultes.

Asclepiadeæ.
Hemidesmus indicus, Br.

Gentianaceæ.
Hoppea dichotoma, Willd.
Canscora decurrens, Dalz.

Boragineæ.
Trichodesma amplexicaule, Roth.

Convolvulaceæ.
Argyreia sericea, Dalz. and Gibs.
Ipomæa hederacea, Jacq.
Ipomæa pes-tigridis, Linn.
Ipomæa eriocarpa, Br.
Evolvulus alsinoides, Linn.
Cuscuta reflexa, Roxb.
Cuscuta chinensis, Lamk.

Scrophularineæ.
Linaria ramosissima, Wall.
Limnophilla gratioloides, Br.
Vandellia crustacea, Benth.

Bonnaya brachiata, Link. and Otto.
Striga euphrasioides, Benth.
Sopubia delphinifolia, G. Don.

Lentibularieæ.
Utricularia stellaris, Linn.

Bignoniaceæ.
Sterospermum chelonoides, D. C.

Pedalineæ.
Sesamum indicum, D. C.

Acanthaceæ.
Elytraria crenata, Vahl.
Ruellia prostrata, Lamk.
Ruellia Beddomi, Clarke.
Hemigraphis latebrosa, Nees.
Blepharis boerhaaviæfolia, Pers.
Barleria Prionitis, Linn.
Andrographis paniculata, Nees.
Andrographis echioides, Nees.
Haplanthus verticillaris, Nees.
Justicia diffusa, Willd.

Verbenaceæ.
Lippia nodiflora, Rich.
Tectona grandis, Linn.

Labiatæ.
Ocimum canum, Sims.
Plectranthus incanus, Link.
Anisochilus carnosus, Wall.
Anisomeles ovata, Br.
Leucas stricta, Benth.
Leucas aspera, Spreng.

Amarantaceæ.
Celosia argentea, Linn.
Allmania nodiflora, Br.
Pupalia lappacea, Moq.
Aerua Monsonia, Mart.
Achyranthes aspera, Linn.
Alternanthera sessilis, Br.

Polygonaceæ.
Polygonum plebejum, Br.

Aristolochiaceæ.
Aristolochia indica, Linn.

Euphorbiaceæ.
Euphorbia hypericifolia, Linn.
Euphorbia pilulifera, Linn.
Bridelia retusa, Spreng.
Phyllanthus reticulatus, Poir.
Phyllanthus Emblica, Linn.
Phyllanthus simplex, Retz.
Phyllanthus Niruri, Linn.
Flueggela microcarpa, Bl.
Acalypha indica, Linn.
Acalypha malabarica, Muell.
Sebastiana Chamælea, Muell.

Urticaceæ.
Ficus bengalensis, Linn.
Ficus religiosa, Linn.
Streblus asper, Lour.

Orchideæ.
Habenaria digitata, Lindl.
Habenaria platyphylla, Spreng.

Scitamineæ.
Curcuma montana, Rosc.

Amaryllideæ.
Curculigo orchiodes, Gærtn.

Dioscoreaceæ.
Dioscorea dæmona, Roxb.

Liliaceæ.
Scilla indica, Bak.
Gloriosa superba, Linn.

Commelinaceæ.
Commelina bengalensis, Linn.
Commelina attenuata, Koenig.
Commelina obliqua, Ham.
Aneilema nudiflorum, Br.
Cyanotis fasciculata, Schultes.
Cyanotis cristata, Schult.

Aroideæ.
Theriophonum crenatum, Bl.
Amorphophallus bulbifera, Bl.

Gramineæ.
Paspalum sanjuinale, Lamk.
Chamæraphis spinescens, Poir.
Axonopus cimicinus, Beauv.
Setaria glauca, Beauv.
Apluda varia, Hack.
Andropogon monticola, Schult.
Aristida Adscenscionis, Linn.
Sporobolus diander, Beauv.
Microchloa setacea, Br.
Gracilea Royleana, Hook.
Eleusine indica, Gaertn.
Eragrostis tenella, Roem & Sch.
Eragrostis amabilis, W. & A.
Eragrostis pilosa, Beauv.
Dendrocalamus strictus, Nees.

Polypodiaceæ.
Adiantum lunulatum, Burm.
Adiantum caudatum, Linn.
Cheilanthus tenuifolia, Swartz.
Cheilanthes farniosa, Kaulf.
Actinopteris dichotoma, Bedd.
Marsilea quadrifoliata, Linn.

Lycopodiaceæ.
Selaginella proniflora, Bak.

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

BY

O. THOMAS, F.R.S., AND KATHLEEN V. RYLEY.

IV.

A NEW SPECIES OF LEGGADA FROM MYSORE.

LEGGADA SIVA, sp. n.

A *Leggada* most nearly resembling *cinderella*, but differing from that species in having a longer muzzle and more rufescent coat.

Size medium. Fur soft and mixed with spines. General colour of fur above drab grey with rufescent tips, base of hair ashy grey. Head, face and ears the same colour as back. Feet as usual white. Tail of average length, about equalling the body without the head, dark above and white below. Under surface white, the hairs grey to their bases; line of demarcation on flanks sharply defined. Skull rather longer than in *cinderella*, the muzzle, as indicated by the lengths of the nasals and diastema, distinctly longer.

Palatal foramina shorter and not extending so far backwards, their end opposite the middle cusp of the first laminæ of m^1.

Dimensions of the type. (recorded by the Collector). Those of *L. cinderella* placed in brackets.—Head and body 81 (85); tail 56 (65); hindfoot 16 (16); ear 14 (13).

Skull.—Condylo-incisive length 22·6 (21·8); zygomatic breadth 12 (12); nasals 10 (9·1); breadth of braincase 11·0.

Habitat.—Sivasamudram, S. Mysore. Altitude 2,500 feet.

Type.—Old female. B. M. No. 13. 2. 16. 1. Original number 2070. Collected Nov. 20th, 1912, by Mr. G. C. Shortridge. Presented to the National Collection by the Bombay Natural History Society. One specimen only.

"No. 2070 was trapped among rocks, all of the other kinds of *Leggada* being obtained among patches of scrub jungle." G.C.S.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS.

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part XX with Plate XX.

(*Continued from page 28 of this Volume.*)

Proteroglyphous colubrines or snakes with canaliculate fangs in the front of the maxillæ, are divided into two sub-families, *viz.*, *Hydrophiinæ* the sea snakes, and *Elapinæ*, the poisonous land colubrines. The latter included 29 genera when Mr. Boulenger's catalogue appeared in 1896, one of which—*Naia*—contains the subject

Errata.

For Part XX, with Plate XX, *read* Part XXI, with Plate XXI.

and then Russell

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Nomenclature—(*a*) *Scientific.*—The generic name introduced by Laurenti, was borrowed from the specific title bestowed upon it by his predecessor Linné.

"Nag," the Sanscrit word for snake, is most probably the origin of Linné's "Naja," but why the "j" has been substituted for the "g" it is difficult to understand. It is still more difficult to understand why the word once latinised as "Naja," and accepted by every herpetologist as such for over a century, should appear as a

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BY

O. THOMAS, F.R.S., AND KATHLEEN V. RYLEY.

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Leggada being obtained among patches of scrub jungle. G.C.S.

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BY

Major F. Wall, I.M.S., C.M.Z.S.

Part XX with Plate XX.

(*Continued from page* 28 *of this Volume.*)

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NAIA TRIPUDIANS (MERREM).

THE COBRA.

(Part I.)

History.—As one would expect the cobra is one of the very earliest snakes to receive mention in scientific literature. Long before the inauguration of scientific nomenclature it was referred to. Seba in 1734 appears to have been the first to describe, and figure it. Later in 1754 Linné figured it, and from him it received its scientific baptism under the name *Colober naja.* Laurenti was the next to refer to it under the name *Naja lutescens* in 1768, and then Russell described and figured it in both his volumes which appeared in 1796 and 1801. In addition this authority wrote much on the effects of its poison, and reported many cases of cobra bitten subjects. In the 19th century it is referred to under a host of names by every herpetologist who has written on the Indian snakes.

Nomenclature—(*a*) *Scientific.*—The generic name introduced by Laurenti, was borrowed from the specific title bestowed upon it by his predecessor Linné.

"Nag," the Sanscrit word for snake, is most probably the origin of Linné's "Naja," but why the "j" has been substituted for the "g" it is difficult to understand. It is still more difficult to understand why the word once latinised as "Naja," and accepted by every herpetologist as such for over a century, should appear as a

"Naia" in Mr. Boulenger's works.* I notice Professor Stejneger in his more recent work† adheres to the original rendering of the word, and I also prefer to accept this.

The specific title "tripudians" bestowed by Merrem is from the Latin meaning literally "dancing on the toe." This is obviously in allusion to the cobra's characteristic attitude when excited.

(*b*) *English.*—To Europeans generally the snake is known as "the cobra" a word however applied in Portuguese to any snake. The Portuguese always referred to it as the "cobra de capello" or "hooded snake," and for many years subsequent to their occupation of India the qualifying adjective, now obsolete, was retained to distinguish it from the "cobra monil" or "necklace snake" (Russell's viper), the "cobra de aqua, or "water snake," etc., etc.

(*c*) *Vernacular.*—In most parts of India the cobra is known to the natives as "nag," "nag samp," or some variation of "nag." The varieties that natives pretend to recognise, and to which they apply special names are endless. Every juggler has a dozen qualifying terms, at his command, and no two jugglers will agree in the name they apply to a given individual. One hears of "arege nagoo," "coodum (wheat) nagoo, "jonna nagoo," based on colours resembling that of various cereals, "chinta" or "scinta (tamarind) nagoo," "malle (jasmine) nagoo" and "mogla nagoo" based on the names of plants, "cowri nagoo" and "sankoo nagoo" based on the names of shells, "kala nag," "sata nag," and a host of other "nags." Such names mostly emanate from professional snake men, and are of little or no interest, but there are many other local names that deserve mention. "Naya" is the name applied to the cobra by the Singhalese in Ceylon, but in this Island where so much Tamil labour is employed, South Indian names are frequently heard, such as "nalla pambu" (good snake), and "naga pambu." On the West Coast I heard "murukan" literally "cruel," and "sair-poom," both Malayalam words applied to it. In Mysore the Canarese call it "nagara hava." In Bengal where the two forms, *viz.*, the binocellate and the monocellate are associated, the former is known as "naga gokurra," and the latter as "keauthia", according to Fayrer, Ewart, Nicholson and others with "kala" or other qualifying prefixes "Gorhmon" is another name used in Bengal for pale varieties according to Simson.‡ Mr. D'Abreu tells me that in Behar "goh-manna" and "nag" are in use. In the North-West about Rawal Pindi "chajli" or "chajliwalla" is the common name for the cobra. "Chaj," I understand, is the Pushtu for a winnowing fan, which its dilated hood is somewhat fancifully held to resemble. Another Pushtu name in allusion to the hood is, I am told, common about Peshawar, *viz.*, "chamcha-mar" (spoonsnake). The comparison to a flattened spoon is quite a good one, and has been noticed by natives in other parts. "mywe howk," the usual name for the cobra in Burma implies "hissing snake." In the Chin Hills, Venning* tells us, the vernacular name is "tlua-kan." Flower† writing of Siamese snakes says, the cobra in Siam is called "ngu how." The same authority mentions "toodong sta" as the name for it among the Malays at Kedah. Cantor, however, gives the Malay name for it as "ular mata -ari" (sun snake), and Annandale and Robinson‡ "ular tedong sendok kunyit" meaning "turmeric ladle hood snake."

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* Faun. Brit. Ind. Reptilia and Batrachia and Cat. Snakes, British Museum.

† Herp. of Japan.

‡ Letters on Sport in Eastern Bengal, p. 239.

Varieties.—I think it wisest in this paper to adhere to the arrangement of the varieties contained in Mr. Boulenger's catalogue (Vol. III, p. 380). Though my notes are voluminous and I have examined many hundreds of cobras I do not consider the material I have worked upon adequate to justify the introduction of another system yet. I have appealed through this journal to our readers to assist our Society in procuring specimens from every part of India, and this may be possible hereafter¶.

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* Bomb. N. H. Jourl., Vol., XX, p. 335.

† P. Z. S. 1899, p. 690.

‡ Fasci., Malay, 1903, p. 168.

¶ From the available literature at my disposal, and the much larger materia contained in my note-books I realise that the classification of the cobra (*N. tripudians*) is a very complicated matter. Stejneger (Herp., Japan, p. 394) suggests that a method based on lepidosis, *i.e.*, scale rows, ventrals and subcaudals is more scientific, and might be productive of a better grouping of the varieties than the scheme laid down by Boulenger which gives primary attention to colour, and hood markings. My own views accord completely with those of Stejneger, and I think that most herpetologists would unhesitatingly allow that lepidosis is of far greater importance than coloration. A scheme based primarily on lepidosis however does not pan out as satisfactorily as Stejneger anticipated, still complicated though it remains it is less so than Boulenger's scheme, and it groups the specimens much more satisfactorily in accordance with geographical areas.

I find that in many localities the variations in colour and hood marks are very numerous, whereas there is a very close agreement in scale characters. According to Boulenger's method a specimen from South India (where the scale rows in midbody are invariably 23 to 25) which has no mark on the hood, is grouped with a specimen from the Punjab without a hood mark, though in the Punjab all the cobras have but 21 scales in midbody !. Into the same group falls the *oxiana* of Eichwald, a variety with a range of ventrals and subcaudals distinct from the cobras of the East of Asia, and with a distinct geographical distribution restricted to the North-Western part of our Indian Empire, and beyond. An anocellate cobra from Burma, Java, or even the Philippines falls into the same group, *viz.*, variety *B. cæca*.

It seems to me this method is as unscientific as it is unsatisfactory. The fact is the colour and hood marks of individuals in many localities are too varied to permit of their being grouped satisfactorily on these characters. As an example, take the cobra referred to usually as the black *cæca*. A typical specimen is black, and bears a hood mark. In Fyzabad, U. P., a uniform black or blackish cobra was the commonest form. Many of these had a perfect "spectacle" mark on the hood, many had a modified or disintegrated "spectacle," some had one or more spots which however were placed in the situation usually occupied by the "spectacle" and some rare individuals had no indication of even a spot. The marks in many of these black specimens are obscure, often so much so that they escape notice unless specially looked for, and even then are often but obscurely visible or suggested. In Almora again the prevalent cobra is a black one. Just as in the Fyzabad specimens I find some with perfect spectacles, some with disintegrated spectacles, and some with no trace of a mark. Mr. Mackinnon some years ago told me all the cobras in the Dun were black, and without spectacles, but while I was in Mussoorie he sent me one from the Dun on which I found a very perfect and distinct spectacle. Colonel Bannerman sent me specimen of a black cobra with no hood marks from the Central Provinces All his first specimens, I discovered, showed obscure but unmistakable indications of a disintegrated spectacle, and he had some trouble to eventually find a specimen without any mark at all on the hood. Major O. A. Smith told me the common cobra in Multan is a black one with no hood marks. One that he sent me however had a very perfect "spectacle." From this it appears to me conclusive that the form "*cœca*" does not deserve recognition as a variety apart from "*typica*," and only a few deserve the name "*cœca*" as hitherto understood, many being typically spectacled, and a host of intermediate forms cannot be placed in either category, (*i.e.*, *cœca* or *typica* as previously defined).

The only form I saw in Chitral where it was common was the *oxiana* of Eichwald. One specimen however was uniformly blackish instead of being an olivaceous-brown with darker cross bars anteriorly, breaking up later into an irregular variegation. This specimen however accorded well with the ranges of ventrals and subcaudals found peculiar to variety *oxiana*, and not with those characteristic of the black Indian form called *cœca*, which it so closely resembled. Similarly a specimen from Duki, N. Baluchistan without any trace of dark cross bars anteriorly showed a range of ventrals and subcaudals typical of *oxiana*, and not of the Indian forms, and this should thus, I hold, be classed as an aberrant colour variety of *oxiana*.

Mr. Boulenger arranges the varieties as follows :—

"A.—Forma TYPICA (*C. naja*, *L.* ; *N. lutescens*, *fasciata*, *brasiliensis*, *siamensis*, Laur. ; *C. rufus*, Gmel.).—Yellowish to dark brown above, with black-and-white spectacle-mark on the hood and a black-and-white spot on each side of the lower surface of the hood. 25 to 35 scales across the neck, 23 to 25 across the middle of the body.

(*a*) One or two dark brown cross-bands on the belly behind the hood.

(*b*) Body variegated with darker, and lighter; belly with several dark cross-bands which may extend across the back.

B.—Var. CÆCA (*N. non-naja*, Laur.; *C. cæcus*, Gmel. ; *T. oxiana*, Eichw.).—Uniform pale brown or grey to blackish ; no marking on the hood ; one or more dark cross-bands on the anterior part of the belly ; young sometimes with dark rings. 25-31 scales across the back, 21-25 across the middle of the body.

C.—Var. FASCIATA, Gray (*N. kaouthia*, Less. ; *N. larvata*, Cant.; var. *scopinucha*, Cope).—Brown, olive, or blackish above, often with more or less distinct light, black-edged cross-bars ; hood with a whitish, black edged ring or U, or with a mask-shaped figure ; a black spot on each side under the hood. 25-31 scales across the neck, 19 to 21 across the middle of the body.

(*a*) Body dark brown behind, with light variegations ; two to four blackish cross-bars under the anterior part of the body.

(*b*) Olive to blackish above, the skin between the scales black ;

lower surface of neck white, with a black cross-bar, rest of lower part dark brown or blackish.

D.—Var. SPUTATRIX (*N. sputatrix*, Boie; var. *nigra*, Gray; *N. atra*, Cantor).—Black or dark brown above and beneath, with some yellow or orange on the sides of the head, and neck; young with a pale U or O-shaped marking on the hood, and the chin and throat whitish. 25 scales across the neck, 19-21 across the middle of the body.

E.—Var. LEUCODIRA.—Brown or blackish; no marking on the hood; lower surface of neck yellowish white, followed by a black cross-band, and usually with an azygos black spot anteriorly and one or two on each side. 21-25 scales across the neck, 17 to 19 across the middle of the body.

F.—Var. MIOLEPIS.—Dark brown or black; sides of head and throat yellowish, whitish in the young; no marking on the hood; young with whitish rings completely encircling the body and tail, and with the white of the sides of the neck extending backwards towards its fellow to form an angular band behind the hood. 21-23 scales across the neck, 17 to 19 across the middle of the body."

To these varieties I can add the following which I cannot place in the above scheme.

In Shillong (Khasi Hills, Assam) I was told by three people independently of a bright green cobra that was in the possession of a juggler shortly before my visit. Unfortunately the man had evidently left the station as I could not trace him. Curiously enough talking to Mr. W. Tottenham, Commissioner of Forests in Dibrugarh, a few days before this he mentioned a bright green cobra that he had encountered in North Siam, at a place called Nan on the Mekong River, but which for want of spirit he could not preserve. On my publishing this information in this Journal * I heard from Mr. H. Hampton from the Ruby Mines, Burma, that the natives there report the existence of a green cobra, but though he has tried for years he has failed to procure a specimen. The Burmans call this snake "indaing-mwe-howk." Further two Europeans told him they had seen this snake, but described it as a bright blue. Shan visitors to the menagerie confirm these statements, and report the snake as rare. Variety *viridis* would be a suitable name for it.

I have examined a curious variety of the cobra from the Andamans submitted to me by Dr. Annandale from the Indian Museum. It differs in colouration from anything I had previously seen, and does not conform to anything I have read of. It is fawn coloured and has well defined, broad, black, chevrons running down the back, the apices directed forwards, and the arms ending low in the flanks. The intervals are about one-third to one-fourth the width of the chevrons. Also in the flanks between each chevron is a small black triangular spot. The hood bears a light monocellus. The ventrals and subcaudals are 175 and 65, the scales in midbody 21, and the lepidosis as in a normal cobra except that the præocular shield fails to touch the internasal. If not already christened I suggest for this the name *sagittifera.*

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* Vol. XVIII, p. 331.

Dimensions.—The cobra when adult measures usually from four and a half to five and a half feet. Larger specimens are rare, and six-footers extremely rare. Dr. Nicholson*, who for some time distributed the rewards for poisonous snakes on behalf of the Mysore Government, says that out of 1,200 specimens that passed through his hands at Bangalore only 4 exceeded 5 feet 6 inches, and the largest of these measured 5 feet 8 inches. I have probably examined 500 cobras from various parts of Asia between Baluchistan and Chitral to South China. I have only once seen a six footer and this was sent to me by Mr. P. W. Mackinnon and was killed in the Dun. It taped 6 feet 4 inches. Mr. H. Hampton writing to me from Mogok, Ruby Mines, Burma, early last year, told me he had obtained a specimen of a precisely similar length, which he had sent to the British Museum. He further stated that Mr. Boulenger in acknowledging the specimen told him it was the largest received in that Institution where there are upwards of 70 examples. Mr. Millard has told me of two specimens he has seen, one 6 foot from Khandalla, and another 6 feet 5½ inches, locality not specified. Mr. C. Bateman wrote to me in 1909 that he had killed one of the monocellate variety in the Jalpaiguri District that measured 6 feet 5½ inches unstretched. Writing to Mr. Millard in 1906, Mr. S. H. Pearless said that the four largest examples he had killed at Badulla, Ceylon, measured respectively 5′-11″, 6′-0½″, 6′-6″, and 6′-10½″, and he believed specimens running to 7 feet were on record. *The Pioneer* of the 12th February 1908 contained an account of a 7 foot cobra, quoted from the *Times of Ceylon.* It appears that on the 31st January 1908, Mr. Webster whilst motoring Sir Thomas Lipton in Colombo saw a crowd of natives collected on the road. These proved to be watching a hole in which a snake was partly visible. Mr. Webster by means of a noose of rope managed to extract the snake, and kill it, and it was found to be a cobra of unusual length which when taped measured 7 feet. The account further stated that a local taxidermist set up the specimen. On writing to Sir Thomas Lipton he repeated this story to me, and gave me permission to see the specimen in his residence at Osidge. It is set up in the erect posture with open mouth, showing the fangs. I measured it, and found it taped 6 feet 7½ inches. * Our Society has recently acquired a specimen, from Shamshirnagar, 6 feet 7 inches unskinned. Lyddeker † says one has been recorded 7 feet 3 inches in length, but gives no details of the locality where it was found nor the authority who measured it.

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* **Indian Snakes, pp. 106 and 173.**

General characters.—The head is depressed, the snout rather short, with no canthus, and broadly rounded as seen from above. The nostril is rather large, and occupies the full depth of the suture between the nasal shields. The eye is moderate in size, and the round shape of the pupil can usually be well seen in life. In some specimens however the usually distinct arc of gold at the pupillary edge may be so faint that the pupil does not show up against the iris. There is a more or less obvious swelling in the temporal region over the underlying poison glands. The tongue is blackish at the tips.

The shields on the head are highly polished. A neck is scarcely if at all evident. Just behind the neck the hood commences, and is discussed later. The body is depressed, and there is a more or less distinct narrow groove down the spine. The scales over the back like those on the head are highly polished. The body maintains a fairly uniform girth throughout. The tail is short, and accounts for from one-fifth to one-ninth the total length.

It is very interesting how much the relative length of the cobra's tail differs in various localities, and I wish in my earlier days I had been more careful to record this, for it may, I think, assist in the difficult question of the classification of the varieties. I find that in Cannanore the tail in ♂ ♂ was one-eighth the total length, and in ♀ ♀ about one-ninth. In Fyzabad and Almora the tail is about one-sixth in both sexes. In Chitral it was also about one-sixth, and often in males only two-elevenths. In the Punjab it was as much as one-fifth in some males, and from one-fifth to one-sixth in females. In Burmah it was usually one-sixth in males, and varied from one-fifth to one-seventh in females.

Identification.—This is easy if attention is paid to the lepidosis. The presence of the little "cuneate" scale between the 4th and 5th infralabials (see ‡ Diagram Cun.) will declare the snake a cobra among all *land* snakes. It is found in many of the sea snakes however. Rarely two such scales exist in the cobra, but it is very rarely absent on both sides. Another important relationship is that of the præocular with the internasal shield. (*Vide* figure Pra. and Int.) This is only seen in the snail snake, *Ambly-*

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* Jour. Bom. Nat. Hist. Soc., Vol. XXI, p. 718.
† Royal Nat. Hist. Reptilia and Fishes, p. 223.
‡ Will be published in the second part.

cephalus monticola peculiar to the Eastern Himalayas, the Assam Hills, and Nicobar Islands, and as an abnormality in the little *Xylophis perroteti* known from the hills of Southern India. In neither of these does the 3rd supralabial shield touch the eye as it does always in the cobra.

If a typical hood mark is present either of the monocellate, or binocellate type the diagnosis is also easy, but in many specimens there is no hood mark at all, and in death rigor mortis stiffens the joints so that the hood is not easily demonstrable. It is for this reason that attention to shield characters is recommended. If the hood is seen dilated in life there should not be any doubt about the snake, but it must be remembered, that the hamadryad (*N. bungarus)* has a well developed hood and that other snakes flatten the neck to a more limited degree. The cobra has been confused by Europeans and natives with the *Pseudoxenodon macrops* in the Eastern Himalayas, and Assam, and Burmese Hills, and with the *Zamenis fasciolatus* a snake common in the Western Ghats, but also known from the Eastern Ghats, and the Ganges Valley.

Disposition.—The cobra is usually not an aggressive snake. When flushed in its native haunts it nearly always tries to escape, and usually succeeds in doing so, but is often shot before it gets to a place of safety. I have encountered many, and find that at close quarters if suddenly disturbed, or it may be if stepped upon, it quickly erects itself, hisses loudly, sways backwards and forwards and awaits its opportunity to strike. If one keeps still, the menace is quickly over, and the snake drops its head, and slinks off. An incautious movement however causes it to turn, erect itself once more, and challenge the intruder again. Many good observers have remarked on its timid nature. Mr. Phipson even went so far as to describe it as an exceedingly timid snake. Elliot* says : "Of one thing I feel certain, the cobra is a timid snake, that it is not at all inclined to bite, and unless assailed, and so infuriated will not bite, even if trodden on by accident so long as the snake is not hurt." He cites two cases known to him where a cobra was actually stepped on, but in neither case did it inflict a bite. Wall (A. J.) remarks that a full grown cobra can be handled with perfect safety, and Flower mentions one that was picked up in his garden by a servant, and brought to him alive not having attempted to bite him.

In Chitral one day an adult passed right through my pony's legs, whilst I was walking along the road with another mounted officer. The snake did not even erect itself though in danger of being trodden upon, but glided through the pony's feet, and then when three or four yards distant turned, half erected itself for a second, and then glided off down a bank. I could quote many more incidents and opinions illustrating the unaggressive temper of this snake, but on the other hand I have certainly witnessed many incidents of a completely contrary character. The cobra is sometimes very fierce, and when disturbed may be a very dangerous snake to encounter. Whatever spirit and aggressiveness may be natural to it in the early days of captivity, I think all will agree that it is very easily tamed. This is evident to anyone who has seen jugglers, and professional snake-men with their captive specimens. If a specimen has been on show for long, it will often require a good slap on its back to provoke it to erect itself and hiss. The cobra that will do so without such treatment one may depend upon it has been but recently deprived of its liberty.

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* Gold, Sport, and Coffee Planting in Mysore, p. 164.

Young cobras are much more dangerous than adults as a rule. They seem more on the alert, more easily excited, and strike repeatedly and with much malice. Wall (A. J.) speaks in similar terms when he says: "When the young cobra is hatched, it is very small, very irritable and exceedingly dangerous. A full grown cobra can be handled with perfect safety, but a young one, ten or eleven inches long, is so active, and its body is so small, that it can be scarcely touched with impunity." It is certainly significant that one never sees a young cobra in the hands of jugglers.

The cobra's effective striking range is a very limited one. I believe the erection of its forebody and the expansion of its hood are invariable preliminaries, and the height to which it can erect itself forms the radius of its stroke. This radius when the snake is erect is very deceptive, appearing much greater than it proves to be when measured along the ground on the completion of its stroke. Jugglers from long practice estimate this range wonderfully, and contrive to evade their captive's menace, with remarkable precision, withdrawing their hands often only a few inches from the spot where the stroke is delivered.

The bite is often a mere snap of the jaws, and the bitten part immediately released, but sometimes the snake will fasten itself tenaciously, necessitating a forcible opening of the jaws to effect release. Mr. Donaghy told me of an incident witnessed by him where a young sampwalla was bitten, and the snake hung on to him so that it had to be removed by forcibly prizing open the jaws. Sometimes after a bite a drop or more of venom may be seen on the skin of the bitten subject which may be wiped off without gaining access to the punctures inflicted. More rarely poison is shaken off in the form of a spray or jet by the forcible thrust forward of the snake, which may fail to reach the object of its attack.

I have on more than one occasion witnessed this with jugglers who unconcernedly wiped away the poison emitted. In our

Journal* Mr. Goring Jones reported a cobra at Mandalay striking at Lieut. Gibson who was bending down near the snake. He was not actually struck, but had poison ejected into his eye, much swelling and pain following. A Hospital Assistant of mine, whilst trying to dislodge a cobra that had taken refuge in the wall of his garden, had a jet of poison ejected into his face. Mr. Kinnear tells me that in our Society's rooms it is a matter of common observation that cobras "spit" at spectators and leave a spray on the glass. One may presume that some such incident caused Boie to christen one variety of our Indian cobra *sputatrix* (spitter). The habit is well known among certain African cobras, notably *N. flava*, *N. nigricollis*, and perhaps *N. melanoleuca* † I believe the venom ejected is shaken off the fangs, and carried forward by the vehemence of the thrust. In some instances, however, where a shower of spray is reported it is more probably caused by the explosive expiratory blasts from the glottis which occur while the snake is hissing, and to which I refer again later.

Haunts.—The Cobra may be found almost anywhere. I have encountered it in heavy jungle, and in open country far removed from forest growth. The ryot disturbs it in his crops, the mali in Cantonment gardens, and the sportsman when quail, partridge or hare shooting. It is a common snake in almost every populated area, and I have had it sent to me frequently from within Cantonment limits, from the regimental and other bazaars, from Artillery and other lines, the suburbs and actually in the gardens of our largest towns, from inside jails, the godowns of the Supply and Transport Corps, and the Telegraph and such like departments, from the warehouses of various mills, and such like situations. No amount of bustle or disturbance seems to deter it from taking up its abode in man's immediate vicinity. It was sent in to me several times in Rangoon from timber yards, where hundreds of men were working daily, elephants pounding up and down moving timber, engines vibrating and throbbing and circular saws screeching through boles of teak. Even in such scenes of turmoil it will establish itself beneath a stack of wood, or convenient drain, and escape dislodgment for long periods.

Old masonry invariably harbours cobras among other snakes. In Delhi the old walls of the Fort were always a safe draw for the snakeman whom I saw every week bring in his bag—some half dozen or more—to be robbed of their poison, which was being collected for the Government of India. Similarly old cemeteries, and ruined habitations, mosques, etc., furnish ideal quarters for this snake. Another favourite haunt is the loose brick work of old wells. The basements of many houses in Cantonments and bazaars can boast a cobra tenant, and it is not surprising therefore that this snake is so frequently encountered inside bath-rooms, and dwelling rooms, besides stables and servant's habitations. Further afield an ant's nest is often a specially favoured resort, or it may be any hole in the ground, or at the basement of a tree among its roots. It is frequently found near water, and often actually in that element, in which it swims with facility and strength.

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* Vol. xiii., p. 376.

† The spitting snake of S. Africa is usually admitted to be *Sepedon hæmachates* the "ringhals" of the Dutch.

A few cases of cobras climbing trees are reported, the object usually being the plunder of some bird's nest.

It has been occasionally reported in the sea, perhaps carried thence by rivers in flood time, but sometimes no river being in the vicinity it must have taken to the sea of its own free will. In one instance a four footer is said to have managed to board a man-of-war, *viz.*, the Wellington, lying off the Coast of Ceylon at Aripo.* Another account of the incident † however, says that the sailors saw the snake in the sea swimming vigorously towards the ship, and assailed it so successfully with billets of wood and other missiles that it returned to land. Bassett Smith in this Journal‡ mentions one fourteen inches long trying to board the flagship at Trincomalee when lying out about half a mile from land.

Food.—The cobra feeds principally on rats, frogs, toads, and less frequently on birds and it seems to show no special preference for any of these creatures. Its choice in batrachians is largely determined by their size, the most bulky individuals being apparently those most sought after. Thus among frogs it is the bull frog, *Rana tigrina*, which is most usually victimised, and among toads *Bufo melanostictus*, and *B. andersoni* receive special attention, and internal accommodation. Rats and mice are very frequently taken, and I think there can be no doubt the numbers of these vermine are materially checked by this snake. I was astonished in Bangalore some years back to see with what avidity the captive cobra belonging to a juggler, accepted dead mice which he withdrew from his pocket. The man offered them as one would a morsel to a dog and one of his cobras nosed its snout into his hand, and took three mice, swallowing them one after another in a couple of minutes or so. Other creatures are taken as circumstances dictate. The Rev. C. Leigh, S.J., writing from Trichinopoly of his captive specimens told me that after eating two small frogs, and then three middle sized ones, one cobra finally disposed of two squirrels (*Sciurus palmarum*). Sometimes birds are attacked, and killed, especially poultry. In Fyzabad one got under a hen coop one night in a native hut, and killed the hen and six chicks. The snake met its death the next night, swallowing a frog bated on a hook. On another occasion one got into a quailery in Fyzabad, and accounted for 13 birds in the night. One only of these had been swallowed, and it seems to me likely that some or all the rest may have died from fright. Only recently in Almora an officer whilst quail shooting flushed a cobra which he shot in attempting to escape down a hole. The snake was cut in half by the shot and a freshly swallowed quail fell out of the stomach. Ferguson* mentions one in this Journal, that was brought in to him at Trivandrum enormously distended. It measured four feet, and contained a monitor lizard (*Varanus bengalensis*) two feet long. Phipson mentions lizards being taken by the young in our Society's rooms. Occasionally the cobra exhibits ophiophagous tastes. Mr. Millard tells me that one in our Society's rooms ate another with which it was caged, both snakes having seized the same frog, and commenced eating from opposite ends. On another occasion one was observed to eat a wolf-snake (*Lycodon aulicus*). Mr. Frere recently sent me a young example measuring 14½ inches, that was eating a *Lycodon aulicus* measuring 13½ inches. I saw one once in a well in Trichinopoly in the act of devouring a gamma snake (*Dipsadomorphus trigonatus*). Colonel G. H. Evans found one in Burma eating a young snake of the genus *Simotes*. Mr. Kinlock wrote to me of one he encountered at Kil Kotageri. It measured 5 feet 7 inches, and was engulfing a dhaman (*Zamenis mucosus*) 6 feet long. Flower† again mentions one in Siam swallowing a snake (*Macropisthodon rhodomelas.*) Here I may mention that the cobra itself sometimes falls a victim to its larger and more confirmed ophiophagous relative the King cobra (*Naja bungarus*).

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* "Ceylon" by an Officer late of the Ceylon Rifles, Vol. II, p. 89.
† Tennants' "Ceylon," Vol. I, page 193-4.
‡ Vol. XI, p. 547.

Some interesting accounts have appeared in this Journal of cobras eating the eggs of poultry. Mr. C. P. George recovered the egg of a guinea fowl from a cobra's interior, which he set, and in due course hatched out. Miss Hopley in her book on snakes (p. 60) records an exactly parallel incident.

In this case however the egg was a hen's. It was marked after extraction and placed under a guinea fowl, and successfully incubated. Mr. Brook Fox records a cobra that had got into a guinea fowl's nest, and had eaten 6 of the 15 eggs. It was photographed in this state. The eggs were subsequently removed, and set and 3 eventually hatched out. After the publishing of these events Colonel Bannerman experimented on cobras in the Parel Laboratory, to ascertain how long it took for the egg shell to dissolve under the influence of the gastric pieces, and he found that it required about 48 hours. Inspection of the subsequent excrements showed in one case that a few pieces of egg shell were discharged 16 days after the experiment.

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* Vol. X, p. 75.

† P. Z. S., 1896, p. 894, Vol. XVI, pp. 174, 363, 369 and 395.

In captivity many specimens feed eagerly, and thrive well. Mr. Phipson wrote that those in the Society's rooms "fed freely on rats, birds, and toads." Similarly Ferguson said those at Trivandrum took large frogs "with avidity." The Rev. C. Leigh wrote to me that one of his captive specimens ate "rats with relish," and two others "took frogs with avidity." On the other hand Dr. Nicholson speaking of cobras in captivity says "I have never seen a cobra feed and I think that unless fed by force he will starve himself to death." This statement coming from such an authority is remarkable, but it would appear from the methods of some professional snake-men that they too find some of their specimens difficult to tempt with food, for many carry with them a small natural funnel which appears to be part of the shaft of the tibia of a goat, which they insert into some cobras' throats, and into which they break a fowl's egg, or pour milk.

Habits.—The most notable habit in the cobra is the very remarkable pose it adopts when alarmed and which has gained for it world-wide renown. Not only does it erect the forebody to a remarkable degree, but it flattens its neck in a very remarkable, and characteristic way to form the so called "hood." The height to which a cobra can erect itself is usually very much overestimated by the casual observer. I have taken careful measurements on several occasions, marking off the height on a stick when the snake's attention was engaged by a juggler. The measurement of the whole snake in life is not easy, and the lengths given must not be taken as very exact. I found the degree of erection commensurate with the degree of excitement or provocation. One snake measuring 5 feet 2½ inches poised vertically to a height of 13 inches, another 5 feet 4 inches long sat up 15½ inches, a third 6 feet and ½ an inch raised itself 14 inches, and a fourth 5 feet 1 inch, only 7½ inches. On the 20th August 1904 in Bangalore I found a 5 footer just sat up 15 inches, but on the next day in the presence of a mongoose that was causing him much agitation the same snake erected itself 21 inches. Another cobra 1½ inches less in length raised itself just 21 inches under similar provocation. It may be taken then that the maximum limit of erection is about one-third the length of the snake.

The so called "hood" is formed by the action of muscles operating upon the ribs in the region behind the neck. I have examined a skeleton in the museum of the Royal College of Surgeons, London, which is well set up in the erect position, and with the ribs fixed as they would be in the expanded hood in life. The atlas (1st vertebra), axis (2nd vertebra), and the 3rd vertebra have no ribs, but the 3rd has an elongate rib-like transverse process. The succeeding 27 vertebræ have ribs attached to them that are involved in the production of the hood. These ribs are much less bowed than those in the rest of the body, and enjoy a range of movement greatly in excess of the other corporeal ribs. The 9th is the longest on the left side, and measures 41 mm., and the 10th measuring 42 mm. is the longest on the right side. The preceding and succeeding ribs progressively diminish so that an oval outline is given to the hood. The ribs are set obliquely forming an angle of 40° to 45° with the long axis of the spine. In the prone state they are directed backwards, outwards, and downwards, and give a contour to the body almost like that in other parts. In the erect pose the corresponding direction of the ribs would be downwards, outwards, and forwards, but any forward tendency is entirely obliterated by the action of a set of dorsal muscles that not only draw the ribs back till they are completely transverse, but also fully straightens them. During full expansion judging from freshly dissected hood, I think the ribs are also slightly elevated, and the angle made with the spine thereby rather increased. As the overlying skin is but loosely attached it does not in any way hamper the movements of the ribs within, which by their backward extension and elevation enormously stretch it in a lateral direction, at the expense of the ventro-vertebral diametre. The oval shape of the hood, and the flattening produced has been well compared to a shallow spoon, or skimmer. The hood originates high up in the nape, and the head bent strongly at the atlas joint is carried at right angles to it when spread. The arching of the forebody and general pose and movement of the cobra when erect remind one very forcibly of the carriage of a swan's neck. The dorsal skin is very much stretched when the hood is expanded, so that the scale rows are widely separated (see our plate) and as the hood marks are almost entirely confined to the skin, they become very conspicuous. The curious poise adopted can be sustained for a considerable time, certainly many minutes if sufficient stimulus is offered, and continued. Whilst poised with expanded hood the snake sways restlessly forwards and backwards and can be made to bend backwards to an extraordinary degree before losing its equilibrium. It hisses in a fierce explosive manner whilst erect and I have carefully observed caged specimens at this time. I noticed that hissing occurs both during inspiration, and expiration. The inspiratory is the shorter act, and its note higher pitched than the expiratory. It is quavering in quality, reminding one of a knife on a grindstone. The expiratory effort is the longer, louder and lower pitched and intermittently explosive in character. The tongue is emitted during both inspiration and expiration. The throat is very distinctly pouched during both acts, but is far more marked during expiration. The inflation extends as far forwards as the chin shields. Whilst erect the snake inflates its body independently of its hood action, and the inflation affects nearly the whole body length, declining posteriorly till finally lost a few inches before the vent in an adult.

One of the most interesting matters in connection with the cobra affects that ever fruitful subject of discussion "charming." It is clear that many very competent authorities disbelieve in the practice. Mr. Phipson says "it is the constant movement of the musical instrument in front of the snake that keeps it erect and not the noise produced," and this is precisely what many other good observers state. I certainly take this view myself, and came to this conclusion very early in my Indian career. One thing puzzled me at first and aroused my suspicion, *viz.*, why is it that in all the stories one reads of "charming," it is invariably the cobra that withdraws from its snug retreat, whilst other snakes apparently are not susceptible to the captivating (?) sounds of the juggler's pipe? I know of no anatomical difference in the auditory apparatus of cobras from other snakes. I experimented frequently in Delhi in my verandah with cobras. I cut narrow strips of sticking plaster, sufficiently broad to cover the eyes completely. These strips had a double purpose. Not only did they blindfold the subjects of experiment, but being carried right round the head they locked the snake's jaws, and so prevented any chance of my being bitten. This done the snake was released, and in a very short time it relaxed its hood, and assumed a completely recumbent attitude. The verandah in which the first of these experiments was carried out was a crazy wooden structure, and if one moved a chair, or even if a servant walked along the room inside, the snake immediately erected itself as if conscious of danger. On the cement verandah downstairs, it was also noticed that the snakes immediately got up when any one walked along in the near neighbourhood. I had a kerosine oil tin at hand, and when the snakes were recumbent I beat this with a stick close to their heads without their taking any notice whatever. Similarly I blew a bugle close beside them, and if an amateur's attempt at bugling failed to rouse them they must indeed be deaf. The greatest care is necessary in conducting such experiments, to eliminate all other possible means of rousing the snake. For instance if a rusty tin is beaten over the snake, particles will fall on it, and rouse it to attention. Similarly if the blast of air emitted from the bugle, impinges ever so little on the snake, it is roused to action, and erects itself.

Many people suppose that a snake is deaf, but this is not the case. Snakes hear well though they have no external ears. Many people are not aware that there are two ways in which the essential auditory apparatus may be stimulated, and sounds heard. If one strikes a tuning fork, and places the stem on any part of the skull, or even the spine to its lowest part, the vibrations can be heard distinctly. If the head is in contact with a table, and the tuning fork struck, the sound is audible when the stem is placed on the table at some distance though inaudible when not touching the table. This is due to the conduction of vibrations through solids and such vibrations are better heard, and for a longer time than those conducted by waves of air which strike upon a membrane "the drum," situated at varying depths (according to the particular animal) in a canal in the skull (the external auditory meatus). The drum set vibrating acts through a chain of tiny bones in the middle ear, so as to affect fluid contained in semicircular canals in the internal ear, the fluid in its turn communicating the vibrations to highly specialised sense organs at the termination of the filaments of the auditory nerves. These nerves carry the impulses received to the brain centres where they are interpreted as sounds. This latter method of conduction, *viz.*, by means of the air is the predominating one in mammals, birds, and many reptiles, but is entirely wanting in all snakes, there being no external orifice, and no drum to receive impressions. Conduction by solids is however good in snakes, perhaps for all we know more highly sensitive than in man.

Now it is obvious that if snakes have no ear openings and no drums they cannot hear sounds conducted by air, such as those emitted by musical and other instruments. This accounts for the cobras taking no notice of the noises I made at close quarters, though they were keenly alive to sounds such as footsteps communicated through the ground. If one is to believe the wonderful stories, told in good faith I have no doubt, about "charming," one must explain it by assuming that snake charmers are possessed of some occult force not apparent to the spectators, for it cannot be explained through the agency of sound conducted by air. As a matter of fact a snake charmer in Bangalore with whom I had become very familiar admitted to me that snake-men knew that snakes were deaf, and that the whole of their "charming" was a hoax. It is most certainly the incessant movement of the man's arms while piping, or the restless movements of his knees while squatting that affords the necessary stimulus, and keeps the cobra excited, and erect.

It is very curious how all absorbing movement is to the cobra. Mr. Phipson says " you have only to attract its attention with one hand, while you seize it in the middle of the body with the other and the snake is yours. It strikes in every direction *especially at any moving object*, but it never seems to occur to it to turn, and bite the hand that is holding it as almost all other snakes would do at once." I fully agree with all Mr. Phipson says on this subject, and consider this strange trait argues a very great lack of intelligence.

The cobra seems to show a decided tendency to a social life. Many writers have remarked upon its habit of living in couples, and this is specially true during the breeding season. It appears however to seek society apart from sexual impulses for on one occasion in Rangoon two were brought to me found coiled together beneath a stack of wood, and both proved to be females. On another occasion, also in Rangoon, a Burman dug out a hole where he had seen a snake make good its escape. The result was the discovery of three cobras. Two of these were males, and one a female which showed ovarian follicles obviously fertilised and enlarged. This leads one to ask the question does the cobra on occasion practice polyandry? Mr. Fitzgerald once told me that he saw three large snakes go into a hole in his compound within a few minutes. He had possessed himself of his gun as speedily as possible, and shot the third snake before it had quite disappeared, and this proved to be a cobra. He assumed the others to have been of the same species but unfortunately did not verify his suspicions.

The cobra is frequently abroad during the day. I have several times met one when bird nesting, shooting or out after butterflies. Many of these were obviously not roused from a siesta, but were roaming about I suppose in search of food or drink. In populated areas it is perhaps more frequently encountered at night. Mr. Hampton tells me his captive specimens did not usually show themselves until mid-day, or the early afternoon, and remained out till about 10 p.m.

Like other snakes it suffers from thirst, specially in the hot weather, and I daresay that many of its intrusions into bath-rooms and its lodgment in catch-pits and wells may be accounted for in this manner. I saw one in the possession of a snakeman in Cannanore that dipped its head into a tin of water presented to it, and drank greedily, each gulp being plainly visible in the throat.

(*To be continued.*)

A LIST OF KALAW BIRDS, WITH BIRD-NESTING NOTES.

BY

J. P. Cook.

My collection and observations were made during the month of April 1912. The area covered was in the immediate vicinity of Kalaw, with exception of two days' collecting at Wetpyuye, about eight miles to the west, with an elevation of 3,200 feet.

Kalaw is situated about 60 miles to the south-east of Thazi, a railway town of the Meiktila District, Upper Burmah. It is a small village of the Southern Shan States, but will shortly become a rather important station on the Southern Shan States Railway, and also probably a popular Hill Station.

The country round Kalaw, with exception of one or two abrupt ridges, is undulating, and is wooded for the most part with pines. There is a certain amount of scrub and secondary jungle between the plots of cultivation, consisting chiefly of longish grass, wild raspberry bushes, and a sprinkling of secondary bamboo. The ridges are rather rocky, the vegetation consisting mostly of long grass and oak trees.

Colonel Rippon contributed a list of the birds he and Mr. E. W. Oates collected at Kalaw to "The Ibis" for July 1896 and January 1897, which he has very kindly given me permission to quote. I have decided therefore to include all the birds he records in the following list in addition to those which I myself collected. Colonel Rippon's list numbered 109 species. The following list contains 129, or 20 additions.

I should like to take this opportunity of thanking Colonel Rippon for the help and encouragement he gave me in my collecting, and for forwarding to the Natural History Museum specimens of a species, the identification of which we were doubtful. This has now been identified as *Chrysomitris ammbiguus*, The Yunnan Siskin.

I think it probable that the following list of Kalaw birds is far from complete, and that there is still plenty room for additional discoveries. There are many birds recorded by Col. Rippon from the Southern Shan States as being found at elevations corresponding with that of Kalaw, but which neither I, nor does Col. Rippon appear to have, found at Kalaw itself.

For example, Col. Rippon records the following Laughing Thrushes from Southern Shan States in "Ibis," Vol. I, page 529, October 1901 :—

Garrulax pectoralis (72)—" Reaches up to 4,500 feet."

Trochalopterum melanostigma (86)—" Fairly common above 3,500 feet."

Trochalopterum ripponi.—" This is the commonest of all the Laughing Thrushes found in the Southern Shan States at elevations from 4,000 to 6,000 feet."—Rippon, "Ibis," page 529, Vol. I.

(Note—Numbers in brackets correspond to numbers in Fauna, B. I. (Birds).

List of Kalaw Birds.

1. *Corvus macrorhynchus* (4)—The Jungle Crow.
2. *Corvus insolens* (8)—Burmese House Crow.

Note—I include this as doubtful. I did not actually shoot bird.

The former of the above pests is much the commoner at Kalaw. I found a nest placed at the very top of a high pine tree, close by the house I was occupying. According to Oates, it is unusual for this crow to nest close to human habitation. But *Corvus marcorhynchus* is a very bold bird at Kalaw usurping the place of its congener *Corvus insolens*.

3. *Pica serica* (10a).—Chinese Magpie.

I did not observe this bird myself, although Col. Rippon records "*Pica rustica*," but probably referred to above species, as *Pica serica* at the time he drew up his list had not been distinguished as a sub-species.

I found what I took to be at the time *Pica rustica* (now *Pica serica*) very common east of Taungyi some years ago, and I think the occurrence of *Pica serica* as far west as Kalaw is rare.

4. *Urocissa occipitalis* (12)—Red-billed Blue Magpie.

Extremely common birds at Kalaw, and, if a poacher, must be responsible for the destruction of many nests. They are, however, I found, very fussy where their own family arrangements are concerned, the present bird of a nest, containing apparently young, being very pugnacious and fainting attacks at a party, of whom I was one, and at the dog accompanying us, when the nest was approached.

5. *Garrulus leucotis* (25)—Burmese Jay.

I met with this bird several times in the Oak country. I was fortunate in finding a nest with a nice clutch of 5 eggs on the 21st of April, on an isolated hill, about 5,000 feet elevation, sparsely wooded with oak. The nest was situated about 10 feet from the ground and built on the fork of a lateral branch, close to its extremity. The parent bird sat very tight, and had to be driven from the nest. The eggs were slightly incubated. In colour they corresponded with the uniform pale green type, with a dark zone round the larger end, and with very fine black streaks, as described by Major H. H Harington (J. B. N. S Vol. xx., page 1004). The nest, although rather bulky and outwardly roughly constructed, was not very conspicuous, owing to the twigs of which it was built harmonizing very closely with its surroundings. I found another Jay's nest on the 28th of April, situated in a very similar site, and of the same construction, containing two young birds and an egg.

6. *Parus commixtus* (32c).—Chinese Grey Tit.

Col. Rippon recorded *Parus minor* from Kalaw, but as the sub-species was described since he compiled his list, I fancy the bird he refers to is identical with abovenamed sub-species.

I found this bird very common at Kalaw in the pine woods, but I failed to find any nests until just a day or two before the end of my stay. This nest was, however, deserted after one egg had been laid. It was composed of a pad of moss and a few feathers, and situated in a deep crevice of a partially rotten and much charred pine stump, about a foot from the ground.

7. *Ægithaliscus pulchellus* (36a).—Rippon's Tit.

Recorded by Col. Rippon from Kalaw, but I failed to find any birds.

8. *Machlolophus spilonotus* (41)—Black-spotted Yellow Tit.

Recorded by Col. Rippon, but I myself did not observe it.

9. *Dryonastes sannio* (67)—White-browed Laughing-Thrush.

An extremely common bird. I found many nests, all situated in thick bushes. April seems to be the chief breeding month, as all the nests I found contained fresh eggs, and with one exception the clutch was three eggs. The exception contained four eggs. All eggs were very pale blue in colour, the average measurements being 1·1″ × 3·8″. The dates on which I took clutches were April 8th, 12th, 15th, 18th, 22nd and 27th. The nests were very compactly built, being composed externally of rough grass and bracken. The inside cup-shaped, roughly formed of leaves, and neatly finished off with fine grass.

10. *Pomatorhinus nuchalis* (117)—Tweedale Scimitar Babbler?

I record this bird from Col. Rippon's lists. I shot several birds which I took to be *P. nuchalis*, but decided, on examining them, that they were

P. olivaceus. On comparing my skins with series in the Natural History Museum, however, I found they differed from the series of skins labelled "*P. olivaceus*" in museum, but exactly corresponded with series labelled "*Pomatorhinus olivaceus ripponi*," and I think it is just possible that the bird Col. Rippon records may belong to this species.

11. *Pomatorhinus ripponi* (118a)—(Bull, B. O. C., Vcl. XXXII, page (9). Common on the grass lands. I found two nests—the first on the 7th of April containing three eggs on the point of hatching; the second nest, with also three eggs, but quite fresh, I found on the 23rd. Both nests were globular in shape, and composed of coarse grass loosely woven. The former was placed on sloping ground between the stems of a clump of tall grass; the other nest was placed on flat ground, but amongst thin grass. The nest was so moulded into a little depression that the top of the nest was little above the surrounding ground level. The eggs were pure white and elliptic in shape, and measured—one egg 1″ × ·70″, two eggs, ·99 × ·69.

12. *Pomatorhinus imberbis* (129*a*).

Fairly common, but not so common as last species, although being found in much the same sort of country.

Curiously enough, I found this bird's nest within a few feet of the nest of *P. ripponi*, although on a different date. Both were found on a small patch of thin grass and a little scrub-jungle, one of the few of such like that had not been burnt. Cattle were regularly grazed over it, and much of the grass had been trampled down. It is a marvel the nests had not been destroyed before I had the good fortune to find them.

The nest of *P. imberbis* was constructed very much like that of *P. ripponi*, but larger and rather more clumsily built of coarse broad grass stems and lined with fine grass. When first found, the nest contained only one egg, which I left in the hopes of obtaining a full clutch; but, although I waited until the solitary egg was almost incubated, no more were added, much to my disappointment. The egg was in shape similar to eggs of *P. ripponi*, and pure white, measuring 1·05 × ·80. Date, 13th April.

The parent bird was very cunning in its attempts to elude detection on leaving its nest. The first occasion on which I approached the nest I saw something brown scuttle away from the spot through the grass, which I mistook for a squirrel, but this, after it had gone some distance, I discovered was the bird, its tail trailing on the ground. I made a second attempt to shoot the bird off its nest, but it eluded me, and I eventually had to wait and shoot it as it stealthily and cautiously returned.

On the 28th of April I shot a nestling, which was at the time in company with its parents, and just able to flutter from tree to tree. As the plumage of the immature bird does not appear to have been hitherto recorded, I append a description of it.

Upper Plumage similar to that of adults. Also colour of soft parts.

Lower Plumage differs from adult in the extreme point of chin only being white, a few adult white feathers appearing on the throat. The remainder of plumage bright rusty, paling to whitish on the abdomen.

Measurements of immature *P. imberbis* compared with adult bird :—

	Adult.	Immature.
Bill	1·4″	1″
Wing	3·5″	3·2″
Tarsus	1·4″	1·2″
Length	8·8″	6·8″
Tail	3·5″	8·2′

13. *Pyctorhis sinensis* (139).—Yellow-eyed Babbler.

Recorded by Col. Rippon.

14. *Pellorneum minus* (143).—Sharpe's Spotted Babbler.

I had some doubts as to the identification of the parent bird of a nest I found. The bird differed from *P. subochacheum*, in having pronounced cream edges to the feathers of the side of the neck, almost forming a complete necklace, and on comparing the skin with series of skins in South Kensington Museum of both *P. minus* and *subochacheum*, I found my specimen corresponded with *P. minus*.

The nest was placed on the edge of a path across a slope, where dried leaves had accumulated. The roof of the nest was covered with leaves, and as it was almost flush with the leaf-strewn ground, was very difficult to see; indeed had not the bird flown out of the nest at my feet I probably should never have found it. The nest was domed in shape, constructed of coarse grass, and lined with fine grass. The eggs, three in number, were quite fresh. Colour white, densely marked with purplish and reddish-brown spots. Date—25th April.

15. *Stachyrhidopsis rufifrons* (173).—Hume's Babbler.

Not observed at Kalaw, but shot at Wetpyuye, 8 miles to the West, in low bamboo jungle. Elevation 3,200 feet.

16. *Mixornis rubricapillus* (176).—Yellow-breasted Babbler.

Not found at Kalaw. Fairly common on the Ghaut, 1,200 feet, where I found two nests on May 1st containing hard set and fresh eggs respectively.

17. *Myiphoneus eugenii* (188).—Burmese Whistling Thrush.

Only one seen at Kalaw along a small wooded stream, one of the two in the neighbourhood. This bird is very common on the road up the Ghaut, where it runs along a fairly large stream.

18. *Lioptila melanoleuca* (206).—Tickell's Sibia.

Col. Rippon records having once obtained this bird at Kalaw. I did not observe it.

19. *Lioptila castanoptera* (207).—Fea's Sibia.

Very common in the scrub jungle, and although from examination of specimens I shot they appeared to be breeding, I failed to find a nest.

20. *Actinodura ramsayi* (212).—Ramsay's Bar-wing.

Occasionally met with in the thickets. Breeding in April, but did not find nest.

21. *Zosterops aureiventris* (227).—Hume's White-eye.

22. *Zosterops simplex* (228).—Swinhoe's White-eye.

Col. Rippon records both of above species from Kalaw. I obtained birds, the parent birds of nests, which I at the time took to be, of each above-named species respectively. Col. Rippon remarks ("Ibis," Vol. I, page 534) that the former "appears to me to grade into the next species." This is exactly what I found. Certainly the amount of yellow on the abdomen of one of my specimens was rather conspicuous, and this I named *aureiventris*, but on comparing the skins with the series of skins named "*Z. aureiventris*" in the South Kensington Museum, I found my bird had not the very decided band down the abdomen of the Museum series, also the colour of the back much more resembled *simplex*, being of olive instead of yellowish green, the tail also being longer. I therefore came to the conclusion that my specimens were *Z. simplex*.

23. *Pteruthius æralatus* (238).—Tickell's Shrike Tit.

Recorded by Col. Rippon.

24. *Ægithina tiphia* (243).—Common Iora.

The only bird of this species I met with was carrying nesting materials.

25. *Chloropsis hardwickii* (249).—Orange-billed Chloropsis.

I obtained this bird at Wetpyuye, 3,200 feet, eight miles from Kalaw.

26. *Psaraoglossa spiloptera* (261).—Spotted-wing.

Recorded by Col. Rippon.

27. *Hypsipetes concolor* (270).—Burmese Black Bulbul.

Fairly common. While at Kalaw I tried to find a nest of this bird, but only succeeded on the last day of my stay—the 30th of April. The parent birds gave the nest away. I was attracted by their excited behaviour, as they kept flying to and fro, erecting the feathers of their head and calling the while. After watching for some time, I saw one of the birds hop along the branch of a huge pine tree and suddenly squat, and I then realized she was on her nest, which I had not till then been able to see. It was a great height up, some 50 or 60 feet, and situated towards the extremity of a branch, just on a small fork. It appeared to be very shallow and covered with cobweb, which harmonized with the colour of the branch. In order that the nest might be examined, it was necessary to erect a scaffolding up to it, as the branch at the site of the nest would not have borne a man's weight. Fortunately some carpenters were close by building a house, and from them I borrowed some bamboos, ropes, etc., and my Burman pluckily managed to reach the nest, to find it contained alas! young birds. The finding of the *H. concolor's* nest had often defeated me previously, as I never imagined they nested at such a height from the ground.

28. *Hemixus tickelli* (276).—Tickell's Bulbul.

Recorded by Col. Rippon.

29. *Alcurus striatus* (277).—Striated Green Bulbul.

Recorded by Col. Rippon.

30. *Molpastes nigripileus* (280).—Tenasserim Red-vented Bulbul.

Seems to take the place at Kalaw of *M. burmanicus*, but not so common, as *burmanicus* is on the plains. I found two nests, both in wild raspberry bushes—one with 2 eggs dated 13-4, the other with 3, dated 24-4. The eggs in the latter nest were almost identical to *M. burmanicus*, but the eggs of the former clutch were pinkish, thickly mottled with red, and with no purple markings.

31. *Xanthixus flavescens* (287).—Blyth's Bulbul.

Recorded by Col. Rippon.

32. *Otocompsa emeria* (288).—Bengali Red-whiskered Bulbul.

Not common in the immediate vicinity of Kalaw, its place being taken by *Pycnonotus xanthorrhous*, but fairly common close to the stream and marshy land about two miles out.

33. *Otocompsa flaviventris* (290).—Black-crested Yellow Bulbul.

Very common at Wetpyuye and up to about four miles West of Kalaw. Elevation about 3,800 feet, but not noticed at Kalaw. I found a nest, a rather untidy structure, in a raspberry bush at Wetpyuye on the 2nd April, containing two fresh eggs.

34. *Pycnonotus xanthorrhous* (298a).—Anderson's Bulbul.

Very common in the scrub jungle round Kalaw. I found several nests. These were cup-shaped and very neatly built of grass and bracken, and lined with fine grass. The usual site chosen for the nest was a raspberry bush, but I found several nests built in thick clumps of grass close to the ground.

The eggs are of two types, one being richly and thickly marked with purple and dark red-brown; the other pinkish, thickly marked with pinkish red. The date of the first nest found was April 3rd and of last nest April 28th, containing fresh eggs. *P. xanthorrhous* suffered terribly from some nests-robber, human or otherwise. Nor was it the only bird. *D. sannio* was also in a like plight. Over and over again eggs were removed from nests I had been watching. I tried hard to find some signs as to how the depredations had been committed, such as egg-shells lying about, but failed to do so. I strongly suspect the magpies, of which there were so many at Kalaw. The little Shan boys might also have been responsible, but I doubt it. At any rate, in no locality in which I have been bird-nesting, have I noticed such a mysterious disappearance of eggs as occurred at Kalaw.

35. *Sitta neglecta* (317).—Burmese Nuthatch.

Col. Rippon records this bird, but I did not meet with any, although finding the next bird (*Sitta nagænsis*) very common, which Col. Rippon does not record.

36. *Sitta naganeis* (318).—Austen's Nuthatch.

Found three nests, but all with young. Dates—April 12th, 15th, and 16th. Two of the nests were in holes made on the upper side of large branches, and could only be found by seeing the parent bird going in. The entrance to nest hole was in every case plastered up with mud.

37. *Sitta magna* (319).—Giant Nuthatch.

Only seen twice. One male specimen procured.

38. *Sitta frontalis* (325).—Velvet-fronted Blue Nuthatch.

Recorded by Col. Rippon, but not observed by myself.

39. *Dicurus cineraceus* (333).—Grey Drongo.

Common among the pine trees. Found five nests, three situated towards the extremity of pine boughs, one of which was quite inaccessible. I was most unfortunate over the eggs. The only full clutch I obtained on April 30th was quite hard set. Another nest was destroyed after two eggs had been laid. The other two nests were disturbed owing to the difficulty in reaching the nests, which were found to contain incomplete clutches of one and two eggs respectively. Dates—15th and 27th April.

40. *Bhringa remifer* (339).—Lesser Racket-tailed Drongo.

Saw a bird and its nest on my way up the Ghaut, April 1st, elevation 3,000 feet. On my return the young birds could be seen moving about, over the top of the nest, which was at the extremity of a branch of a huge tree and quite inaccessible.

41. *Orthotomus sutorius* (374).—Indian Tailor Bird.

One specimen only obtained—a young bird.

42. *Megalurus palustris* (389).—Striated Marsh Warbler.

Seen about a swamp about two miles to East of Kalaw.

43. *Herbivocula schwarzi* (404).—Radde's Bush Warbler.

Fairly common in the scrub and grass land. I mistook the specimens for *Phylloscopus fuscatus* until I compared them with skins in South Kensington Natural History Museum.

44. *Phylloscopus affinis* (405).—Tickell's Willow Warbler.

One specimen obtained.

45. *P. superciliosus* (417).—Recorded by Col. Rippon.

46 *Acanthopneuste davisoni* (430).—Tenasserim White-tailed Willow Warbler.

Occasionally seen on the grassy hills. Found a nest built into a bank, containing young, date 8th April.

47. *Cryptolopha tephrocephala* (432).—Anderson's Flycatcher Warbler.

Recorded by Col. Rippon.

48. *Suya crinigera* (458).

I found this bird common, and obtained nest with four eggs, date 24th April.

49. *Suya superciliaris* (461).—Anderson's Hill Warbler.

I did not shoot any for identification, but Col. Rippon records them, although curiously omits the former bird, *S. crinigera*, which I found common.

50. *Lanius collurioides* (474).—Burmese Shrike.

Common. Found three nests. Two were built in the fork of saplings, one in the fork of a branch of an oak tree. Two nests contained clutches of five eggs, one nest of four. Dates—April 12th, 17th, 27th.

51. *Lanius nigriceps* (475).—Black-headed Shrike.

Only once seen, the parent bird of a nest built in a wild raspberry bush on the edge of a paddy field. Clutch four eggs fresh. Date—14th April.

52. *Lanius tephronotus* (477).—Grey-backed Shrike.

Recorded by Col. Rippon.

53. *Tephrodornis pelvicus* (486).—Nepalese Wood Shrike.

Recorded by Col. Rippon.

54. *Pericrocotus speciosus* (490).—Indian Scarlet Minivet.

Recorded by Col. Rippon.

55. *Pericrocotus fraterculus* (491).—Burmese Scarlet Minivet.

Recorded by Col. Rippon.

56. *Pericrocotus brevirostris* (495).—Short-billed Minivet.

Recorded by Col. Rippon.

57. *Pericrocotus solaris* (498).—White-throated Minivet.

Two specimens obtained.

58. *Pericrocotus peregrinus* (500).—Small Minivet.

Observed, but not collected.

59. *Campophaga melanoptera* (506).—Pale-grey Cuckoo-Shrike.

Several times seen.

60. *Artamus fuscus* (512).—Ashy Swallow-Shrike.

Recorded by Col. Rippon.

61. *Oriolus indicus* (514).—Black-naped Oriole.

Recorded by Col. Rippon.

62. *Oriolus tenuirostris* (515).—Burmese Black-naped Oriole.

Common, but I was unsuccessful in finding nests. Capt. Venning, who was at Kalaw at the time, found two or three towards end of April. They appear to have just begun nesting at the latter end of the month.

63. *Oriolus trailii* (522).—Maroon Oriole.

Fairly common, but not so much so as the last species. I only collected one of the Mynas (*Graculipica nigricollis*), but Col. Rippon records the following :—

64. *Graculipica nigricollis* (546).—Black-necked Myna.

65. *Graculipica burmanica* (547).—Jerdon's Myna.

66. *Acridotheres tristes* (549).—Common Myna.

67. *Æthiopsar grandis* (553).—Siamese Myna.

68. *Æthiopsar albicinctus* (554).—Collared Myna.

69. *Cyornis melanoleucus* (569).—Little Pied Flycatcher.

Recorded by Col. Rippon.

70. *Cyornis unicolor* (574).—Pale Blue Flycatcher.

One specimen obtained. Only once seen.

71. *Cyornis rubeculoides* (575).—Blue-throated Flycatcher.

Common.

72. *Cyornis tickelli* (576).—Tickell's Blue Flycatcher.

Recorded by Col. Rippon.

73. *Stoparola melanops* (579).—Verditer Flycatcher.

One specimen obtained—a breeding male.

74. *Culcicapa ceylonensis* (592).—Grey-headed Flycatcher.

Very common.

75. *Rhipidura albicollis* (605).—White-throated Flycatcher.

Common. One nest found with three fresh eggs. Date—25th April. Nest a beautiful little cone-shaped structure, composed of soft grass, and well plastered over with cobwebs, built in a cluster of forks of a thin dried overhanging bamboo.

76. *Pratincola caprata* (608).—Common Pied Bush-Chat.

Very common. Found several nests. One had young birds at the beginning of April. Two nests contained cockoo's eggs. *Cuculus canorus* or *Cuculus canorus bakeri* (Hartert Vogel der palaarktischen, Vol. 2, page 948).

77. *Oreicola ferrea* (615).—Dark-grey Bush-Chat.

Only saw one, the parent bird of a nest. This was situated under a tuft of short grass on the upper edge of a small path along a grassy slope. The nest contained four fresh eggs, very pale green in colour, sparingly marked at the larger and with rusty brown. Date—21st April.

78. *Copsychus saularis,* (663)—Magpie Robin.

Very common. Nests found April.

79. *Merula protomomelæna* (679).—Black-busted Ouzel.

Met with several times. Appeared to be breeding from dissection of specimens obtained.

80. *Uroloncha topela* (735a).—Chinese Munia.

Fairly common. Found two unfinished nests, end of April.

81. *Chrysomitris ambiguus* (Oustalet) (773a).—The Yunnan Siskin.

I do not think this bird has been recorded previously from Burmah. I found it fairly common among the pine trees, especially so close to the house I was occupying. They were usually seen in small parties, and were conspicuous by their yellow and black plumage as they flew from tree to tree. They appeared to be feeding on the young shoots of the pine trees.

I was especially fortunate in finding the nest on the day that I first became acquainted with the bird. I had shot one in the morning and on returning home, close to the house, I was attracted by a similar bird flying from a pine sapling. On investigation I found the nest. It was well concealed, being built into the pines that clustered at the head of the sapling, which was about six feet high. The nest was composed of dry pine needles, mixed with a little moss roughly bent into a cup shape and lined sparingly with wool and feathers, the whole rather loosely put together, and it came almost to bits on my removing it from its site. The eggs, four in number and quite fresh, were very pale greenish-blue, sparingly spotted with black, chiefly at the larger end, with one or two hair-like streaks. Measurements—·70 × ·53, there eggs; ·73 × ·55, one egg.

82. *Passer domesticus* (776).—House Sparrow.

Common round the village.

83. *Passer cinnamomeus* (780).—Cinnamon House Sparrow.

Recorded by Col. Rippon.

84. *Emberiza pusilla* (791).—Dwarf Bunting.

Seen up to about middle of April amongst the wild raspberries. Later on they seemed to have migrated

85. *Emberiza aureola* (797).—Yellow-breasted Bunting.

One specimen obtained on the Ghaut, 12 miles West of Kalaw, elevation about 3,000 feet.

86. *Melophus melanicterus* (803).—Crested Bunting.

Very common on the open grass land two miles East of Kalaw.

87. *Hirundo smithii* (818).—Wire-tailed Swallow.

Recorded by Col. Rippon.

88. *Hirundo striolata* (820).—Japanese Striated Swallow.

Recorded by Col. Rippon.

89. *Motacilla ocularis* (828).—Streak-eyed Wagtail.

Recorded by Col. Rippon.

90. *Anthus maculatus* (841).—Indian Tree Pipit.

Very common up to nearly end of April.

91. *Anthus striolatus* (846).—Blyth's Pipit.

One specimen obtained.

92. *Alauda gulgula* (861).—Indian Skylark.

Recorded by Col. Rippon.

93. *Æthopyga sanguinipectus* (891).—Walden's Yellow-backed Sunbird.

Recorded by Col. Rippon.

94. *Arachnecthra asiatica* (895).—Purple sunbird.

Seen on several occasions.

95. *Dicæum ignipectus* (915).—Fire-breasted Flower-pecker.

Recorded by Col. Rippon.

96. *Psarisomus dalhousiæ* (944).—Long-tailed Broadbill.

I saw this beautifully plumaged bird occasionally, generally in thickly-wooded ravines. Obtained one specimen.

97. *Gecinus occipitallis* (950).—Black-naped Green Woodpecker.

Shot one specimen, the parent bird of a nest containing four fresh eggs. Date—18th April. The nest hole was in a stump and in height about three feet from the ground.

98. *Hypopicus hyperthrus* (960).—Rufous-bellied Pied woodpecker.

This was one of the commonest woodpeckers at Kalaw I found three nests, but was very unfortunate with the eggs. The first nest hole I found, 16th April, contained one egg. Next day when I visited the spot the parent bird flew off nest. On the 19th I went to take eggs, but found all the chips scattered on the ground and their place taken by some dried pine needles shaped in the form of a nest. Of eggs I could find no trace. Was a Magpie Robin the culprit? The nest-hole was in a rotten pine stump about three inches in diameter, and was situated about two feet from the ground.

The second nest-hole was in a high rotten pine stump about fifteen feet from the ground. On cutting into it, I found only one egg. This was curiously shaped, quite unlike the other eggs obtained, being very elongated. At the bottom of the tree was a broken egg, perhaps dropped while the bird was in flight.

The next day, April 27th, I found another nest in a very rotten pine stump, about two feet from the ground. On approaching it, the parent bird flew out, but when I cut into the nest I found four eggs, of which two were slightly damaged and two broken. This had obviously occurred some time previously, as the yolk was all caked, and yet parent bird had been sitting on four broken eggs! Measurements—·94 × ·64. Abnormal egg measured 1″ × ·60.

99. *Dendrocopus cabanisi* (962).—Chinese Pied Woodpecker.

Found nest-hole on the 2nd April and in a rotten pine stump about ten feet from the ground, and could hear young birds crying within. On the 5th found another nest-hole containing three fresh eggs. In this case a decayed branch of an oak tree had been utilized for nesting purposes. A natural hole from decay led to the egg chamber, but notwithstanding this the woodpecker had excavated another hole for its entrance, just of sufficient size to allow of its passing in. Measurements of three eggs—1·1″ × ·74.

100. *Dendrocopus atratus* (968).—Stripe-breasted Pied Woodpecker.

Recorded by Col. Rippon.

101. *Iyngipicus canicapillus* (975).—Burmese Pigmy Woodpecker.

Found nest-hole in the hole of a fairly large green tree. The aperture was nearly as large as the nest-hole of *H. hyperthrus* just allowing of one's four fingers to fit in. There was a hollow in the interior of the tree and into this the hole led. I found a single egg on the floor of the hollow chamber. It was quite fresh, and though I could not wait to see the parent bird as it was on the last day of my stay—from its size I am pretty confident it belonged to above species. The egg was of the regular woodpecker type and measured ·72 × ·52.

102. *Chrysocolaptes gutticristatus* (992).—Tickell's Golden-backed Woodpecker.

Only one pair seen.

103. *Megalæma virens* (1007).—Great Chinese Barbet.

Only one seen and obtained.

104. *Coracias affinis* (1023).—Burmese Roller.

Very common and in April were making much noise over their nesting operations. Three eggs taken April, 25th.

105. *Merops viridis* (1026).—Common Indian Bee-Eater.

Recorded by Col. Rippon. I found them up to 2,000 feet only, on the Ghaut, West of Kalaw.

106. *Ceryle varia* (1033).—Indian Pied Kingfisher.

Recorded by Col. Rippon.

107. *Upupa indica* (1067).—Indian Hoopoe.

Common.

108. *Caprimulgus macrurus* (1093).—Horsfield's Nightjar.

This appeared to be the common Nightjar of Kalaw I found no other. A specimen I obtained contained an unformed egg.

109. *Cuculus canorus bakeri* (1104a) (Hartert, Vol. P.F.Vol. 2, page 945.)—Hartert has subdivided *C. canorus* into sub-species, *telephonus* and *bakeri*; *bakeri* being the non-migratory bird and presumably the bird found breeding at Kalaw. I have therefore adopted Hartert's nomenclature.

110. *Cuculus micropterus* (1107).—Indian Cuckoo.

Recorded by Col. Rippon.

111. *Hierococcyx sparverioides* (1108).—Large Hawk-Cuckoo.

Common and noisy in April.

112. *Hierococcyx nisicolor* (1110).—Hodgson's Hawk-Cuckoo.

One specimen obtained.

113. *Cacomantis merulinus* (1113).—Rufous-bellied Cuckoo.

One specimen obtained.

114. *Eudynamis honorata* (1120).—Indian Koel.

Fairly common.

115. *Rhopodytes tristis* (1123).—Large Green-billed Malkoha.

Recorded by Col. Rippon.

116. *Palæornis torquatus* (1138)—Rose-ringed Paroquet.

Recorded by Col. Rippon.

117. *Palæornis finschi* (1142).—Burmese Slaty-headed Paroquet.

Fairly common and seen close to the houses in the settlement.

118. *Otogyps calvus* (1191).—Black Vulture.

Seen on several occasions.

119. *Milvus govinda* (1229).—Common Pariah Kite.

Found close to the village.

120. *Columba intermedia* (1292).—Indian Blue-Rock Pigeon.

Recorded by Col. Rippon.

121. *Turtur orientalis* (1304).—Rufous Turtle-Dove.

Very common. Found several nests. One with young. One of the nests found was built on the hole of a fallen tree amongst rather tall grass.

122. *Turtur trigrinus* (1308).—Malayan Spotted Dove.

Common and nests found.

123. *Œnopopelia tranquebarica* (1311).—Red Turtle-Dove.

Only met with once.

124. *Phasianus humiæ* (1331).—Mrs. Hume's Pheasant.

Recorded by Col. Rippon. I saw this beautiful bird or it may have been *P. burmanicus*, 1331a, several times, and generally in the open jungle on rocky grass hills. On one occasion I put up five birds singly at intervals of about a minute or two. At one time I thought I had found a nest, as a hen bird rose at my feet, but I hunted everywhere without success. These Pheasants do not seem to be quite so gregarious as *G. lineatus*, nor so partial to the proximity of water. I should have liked to have shot one or two, but when I saw them I always had my little ·410 with me only, which would not have been sufficient to have brought them down. One one occasion I put up a Pheasant out of some wild raspberry bushes amongst long grass, the fruit of which it was perhaps feeding on.

125. *Francolinus chinensis* (1374). —Chinese Francolin.

Common

126. *Turnix pugnax* (1382).—Bustard-Quail.

Saw a few on the open grass land, two miles East of Kalw.

127. *Grus antigone* (1409).—Sarus.

Recorded by Col. Rippon.

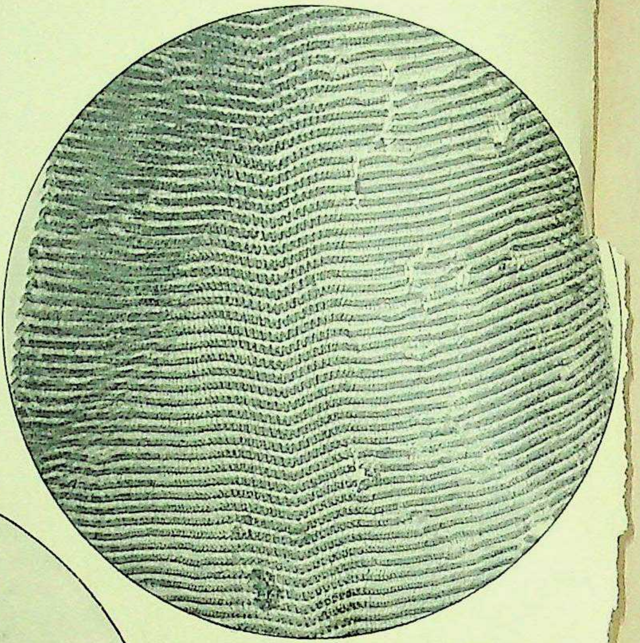
128. *Sarcogrammus atrinuchalis* (1432).—Burmese Red-wattled Lapwing.

Common.

129. *Gallinago stenura* (1485).—Pintail Snipe.

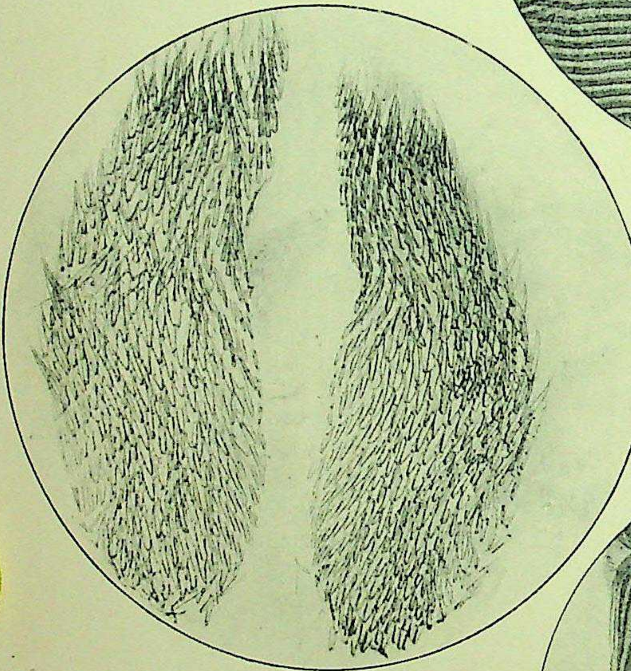
I believe there is good snipe shooting close to Kalaw in the cold weather.

Fig. 1.



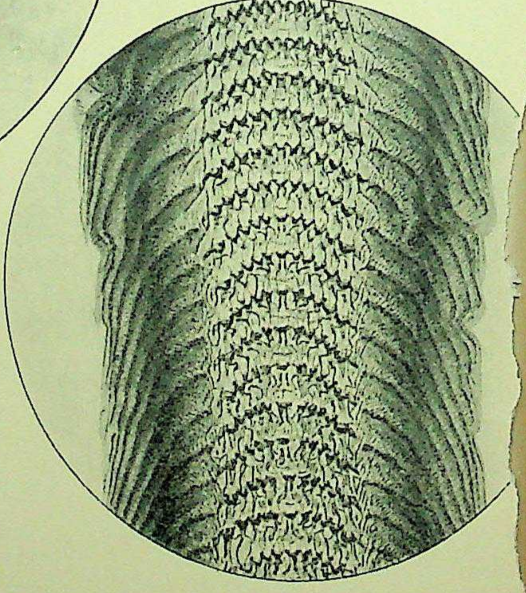
× 29.

Fig. 2.



× 12½

Fig. 3.



× 29.

1. ARIOPHANTA LÆVIPES—Müller. Part of Radula × 29.
2. IANTHINA FRAGILIS—Lamarck. Radula × 12½.
3. POLYDONTA RADIATA—Gmelin. Part of Radula × 29.

THE TEETH OF SNAILS.

BY

MAJOR A. J. PEILE, R. A.

(*With one Plate.*)

Almost all the mollusca, except the bivalves (*Pelecypoda*) possess in the mouth and throat an organ which is sometimes referred to as the palate or the tongue, but which is better called the "radula" or "odontophore." Only a few genera do not possess this apparatus and these are mostly parasitic in their habits and obtain their food by suction of the juices of their hosts.

The radula consists of a band of chitin studded with rows of teeth, each row generally bilaterally symmetrical on either side of a centre tooth. The band lies on the floor of the mouth and is flat in the forward part, but further back often forms almost a tube. The shape, number and arrangement of the teeth differ enormously in different families and even in different genera, so that a study of these beautiful objects is of great interest as affording an insight into the natural affinities of the group.

An excellent account of the organs in question is to be found in the Cambridge Natural History, Volume "Mollusca." These few notes, which are based on the arrangement given in that volume, are explanatory of some of the types which have been mounted for the Society's collection. These were obtained, with one exception, from spirit specimens furnished by the kindness of some of the members. The illustrations are from photographs and drawings of the actual specimens.

A. SCAPHOPODA.

The collection does not as yet possess a radula of this class. Some of the *Dentaiidæ* (tusk shells) are found at Bombay, notably the small *Cadueus gadus*, Sowerby, common as dead shells in shell sand. The living animals burrow in sand and mud.

B. GASTEROPODA.

1. Order *Pulmonata.*—This order contains the inoperculate land and freshwater snails. These possess a radula consisting of numerous rows of minute teeth each on its own basal plate, so that the whole structure resembles the surface of a rasp. Example: *Ariophanta lævipes*, Müller, the common striped snail of Bombay with a sinistral shell. Plate, fig. 1, shows a portion of the radula; at the edge on the left side, where the membrane has been doubled on itself, the hooked form of the teeth may be discerned. Text, fig. 1, shows the form of the central tooth of each row and the adjoining laterals; fig. 2 shows the change in form of the teeth as the edge of the radula is approached, the lateral passing into so-called marginals.

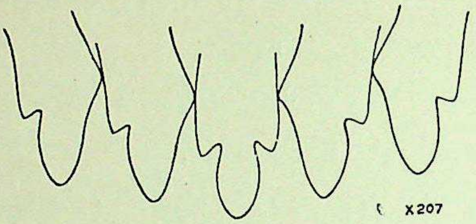


Fig. 1.

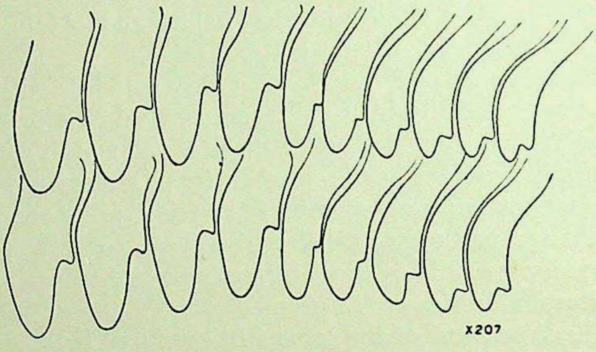


Fig. 2.

Another species in the collection is *Macrochlamys pedina*, Benson also a common Bombay snail, belonging, with *Ariophanta*, to the family *Limacidæ*.

Other well-known families of the order, as yet unrepresented, are *Helicidæ*, *Stenogyridæ* and *Pupidæ* (land), *Limnæidæ* (freshwater) and *Auriculidæ* (brackish).

While most of the radulæ of the pulmonates have a general resemblance one with another, an infinite variety of detail will be found on comparing the different genera. Some of the carnivorous genera possess sickle-shaped teeth, somewhat resembling those of the marine genus *Ianthina* (*see* fig. 10).

The non-carnivorous genera possess, in addition to the radula, a curved mandible placed behind the upper lip of the mouth; this is used for biting their food, while the radula would appear to be used for grating up the particles as they are swallowed.

2. Order *Opisthobranchiata*.—This order which includes amongst others the nudibranchs, the limpet-like *Siphonaria* and the *Bulloidea* is not represented in the collection.

3. Order *Prosobranchiata*.—The families in this order, to which most of the better known marine molluscs and the land and fresh-water operculates belong, may be conveniently classified by their radulæ as follows :—

(*a*) *Toxoglossa* (τόξον = arrow)

Our example is *Conus achatinus*, Chemnitz, which possesses from 50 to 60 long slightly curved shafts, each having a poison gland at the base. Each tooth is wonderfully barbed, *see* fig. 3.

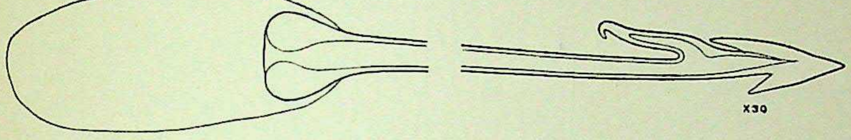


Fig. 3.

The barbs in our species are more remarkable than those of many of the other species of the *Conidæ*. On the other hand some of them (*e. g.*, *Conus textile*) have a serrated edge to the shaft.

(*b*) *Rachiglossa* (ῥάχις = ridge).

Our examples are *Eburna spirata*, Lamarck (fig. 4), belonging to the same family as the British "whelk" (*Buccinidæ*), *Nassa ornata*, Kiener (fig. 5), *Columbella terpsichore*, Leathes (fig. 6), and *Purpura blanfordi*, Melvill (fig. 7). A few complete rows are illustrated in each figure.

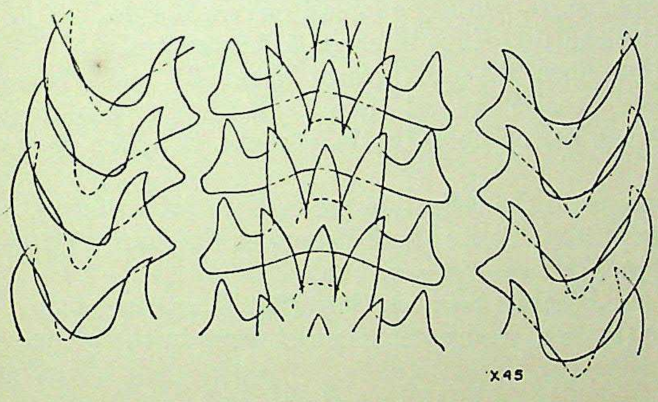


Fig. 4.

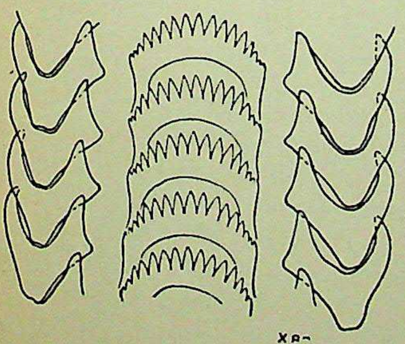


Fig. 5.

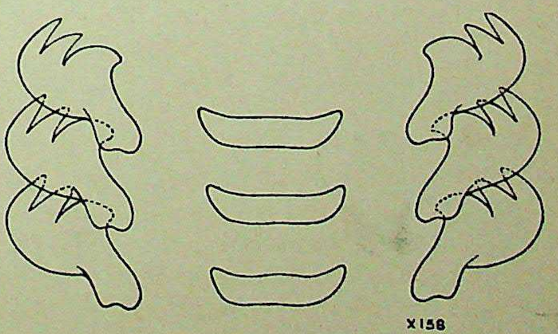


Fig. 6.

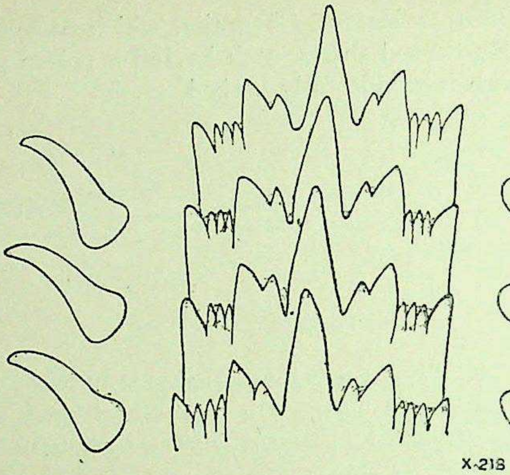


Fig. 7.

These radulæ may all be given the dental formula 1. 1. 1., the figures denoting one central with one lateral on each side. It is interesting to notice the difference in shape of the centrals.

Eburna has about 40 rows, *Nassa* about 65 and *Purpura* about 200. These species are all carnivorous. *Purpura* preys upon other molluscs, boring holes in their shells in order to get at the contents.

Other species in the collection are *Sistrum tuberculatum*, de Blain, and *Purpura tissoti*, Petit; both belong to the family *Muricidæ*.

(*c*) *Tænioglossa* (ταινία=ribbon).

Examples: *Planaxis sulcatus*, Born (fig. 8), marine, and *Ampularia nux*, Reeve (fig. 9), freshwater, from streams in the ghâts.

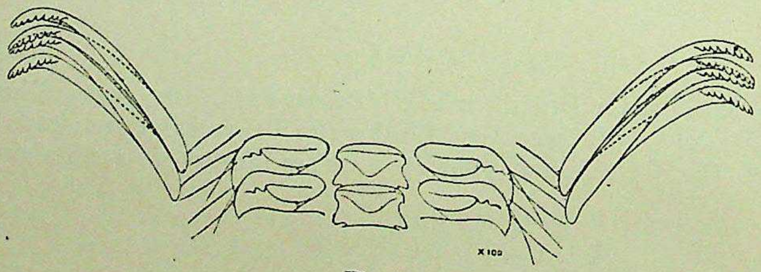


Fig. 8.

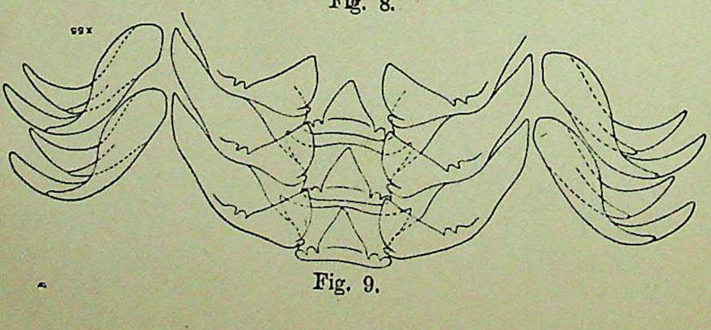


Fig. 9.

These species have two marginals in each row as well as the central and laterals and may be given the formula 2. 1. 1. 1. 2. *Planaxis* has many rows and *Ampullaria* about 40. Another species in the collection is *Paludomus obesus*, Phil. (freshwater) belonging to the *Melaniidæ*, and the *Cyclophoridæ* (land operculates) are represented by *Leptopoma halophilum*, Benson, a small species from Ceylon. Belonging to the *Tænioglossa* are many other well-known families as yet unrepresented, notably *Cypræidæ* (the "cowries"), *Littorinidæ* (the "winkles") and *Naticidæ*. Of all these families Bombay has several species, those of the last named inhabiting the sandy bays. The *Littorinidæ* are remarkable for the extraordinary length of their radulæ, usually many times longer than the animal, the part not in use being coiled up like a watch spring.

Many of the *Tænioglossa* are provided with two lateral jaws, sculptured with elaborate patterns and file-like projections.

(*d*) *Ptenoglossa* (πτηνός = winged).

Example: *Ianthina fragilis*, Lamarck, Plate, fig. 2, shows the whole radula which is formed in two divisions with a gap in the middle. Text, fig. 10, shows a few teeth more highly magnified.

Formula $\infty \cdot 0 \cdot \infty$

The *Ianthinidæ* float on the surface of the ocean and are reputed to feed on jelly fish.

One other family, the *Scalariidæ*, is placed doubtfully with the *Ptenoglossa*; in habits and appearance it is very unlike *Ianthina*. Bombay has a few small and rather rare species, not yet represented in the collection by their radulæ.

(*e*) Two families (*Eulimidæ* and *Pyramidellidæ*), in which the radula and jaw are absent, are classed as *Gymnoglossa* (γυμνός = bare).

(*f*) *Rhipidoglossa* (ῥιπίς = fan).

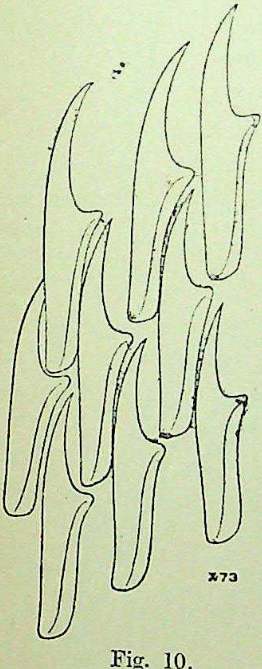


Fig. 10.

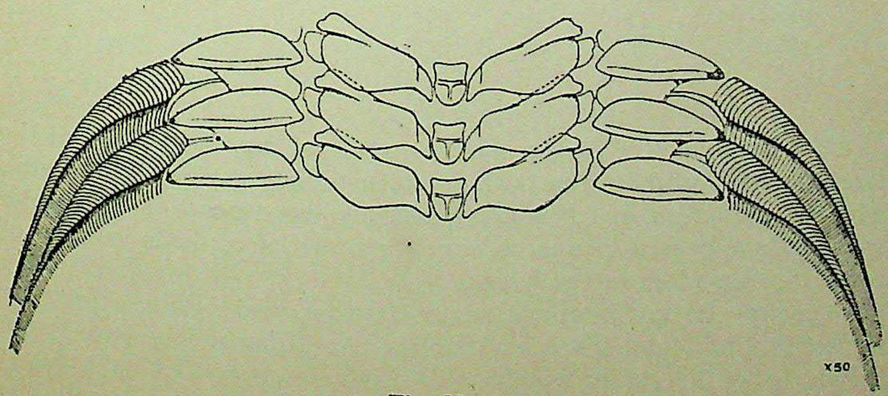


Fig. 11

Examples: *Nerita oryzarum*, Récluz. (fig. 11); *Astralium stellatum*, Gmelin, belonging to the *Turbinidæ* (fig. 12) and *Polydonta radiata*, Gmelin, belonging to the *Trochidæ* (Plate, fig. 3, and Text, fig. 13).

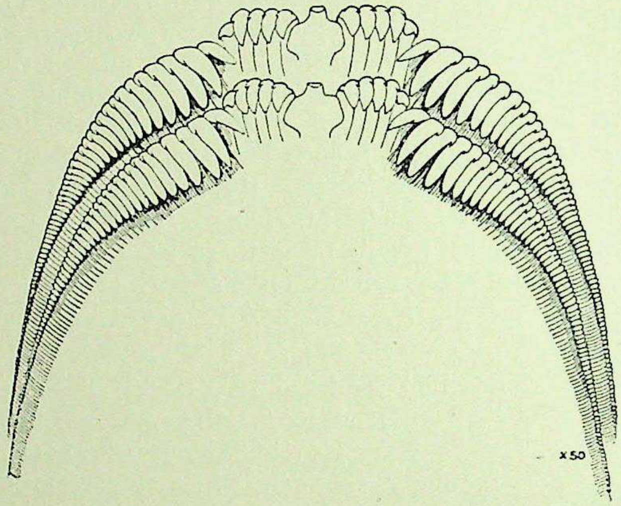


Fig. 12.

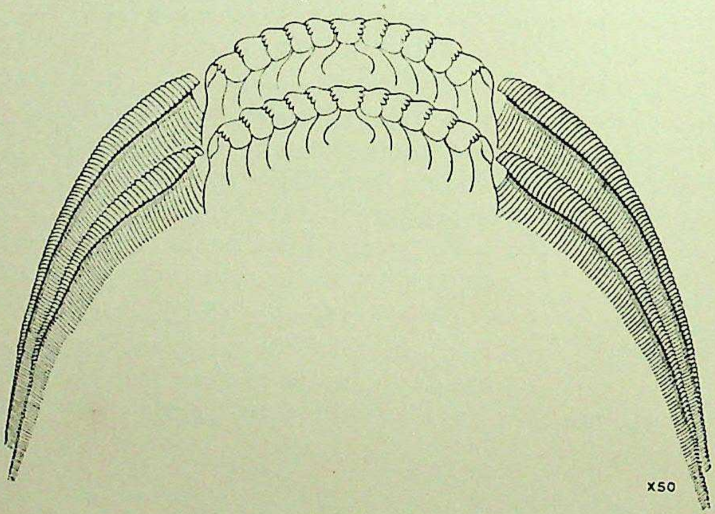


Fig. 13.

The formula for *Nerita* may be stated as ∞·3·1·3·∞ if the large capituliform tooth next the marginals be regarded as a lateral. That for *Astralium* and *Polydonta* is in each case ∞·5·1·5·∞ All these radulæ consist of a large number of rows, only a couple of rows are illustrated in the figures.

Other species in the collection are *Turbo elegans*, Phil., *Clanculus scabrosus*, Phil., and *Euchelus indicus*, A. Adams. The two latter belong to the *Trochidæ*.

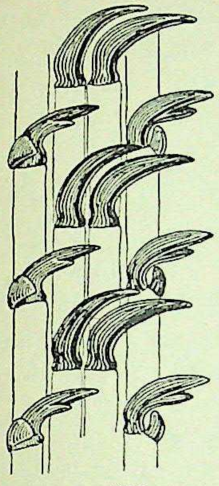


Fig. 14.

All our species are vegetable feeders and are common on rocks, between tide marks, on the Bombay beaches.

Some of the *Rhipidoglossa* possess jaws.

(*g*) *Docoglossa* (δοκός=beam).

Example: *Melcioniscus aster*, Reeve, family *Patellidæ* (the "limpets"). The radulæ of the limpets are of great length, that of *Melcioniscus*, when stretched out straight, is much longer than the body of the animal. A few rows are shown in fig. 14. The formula may perhaps be written as 3. 1. (1. 0. 1.) 1. 3. where the outer figures denote some obscure plates not shown in the drawing and the inner figures denote a pair of identical centrals.

4. Order *Amphineura*.

Example: *Chiton burmanus*, Carpenter (fig. 15). The *Chitonidæ* are creatures, with the habits of limpets, protected by a compound shell of eight overlapping plates connected by a leathery margin. When detached from the rock they have the power of rolling themselves up like a woodlouse. The radula is very large and massive compared with the size of the animal and is very complicated in structure compared with the types we have already examined. Formula for this species may be written 4. 4. 1. 4. 4.

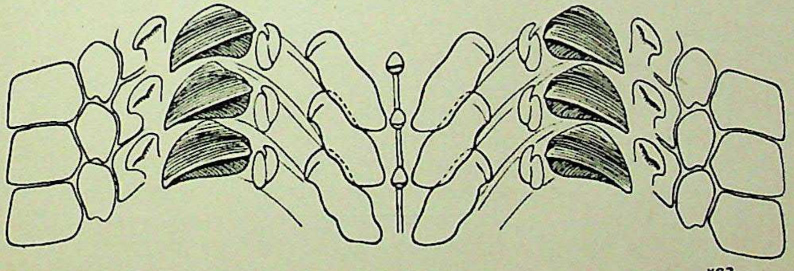


Fig. 15.

The drawing does not show the first lateral on each side which is rather like the central; owing to the manner in which the laterals overlap it is very difficult to distinguish them under the microscope and depict them in a drawing.

C. CEPHALOPODA.

The members of this class, *Octopus*, *Nautilus*, &c., are distinguished by the possession of powerful jaws as well as a small radula. There are no examples in the Society's collection.

In order to mount the radula as an object for the microscope it may be obtained from a large species by dissection and then cleaned by boiling in a not too strong solution of caustic potash. A word of warning is necessary, however, that the largest species do not always possess the largest radulæ.

With small species the proboscis or buccal mass, or even the whole animal, may be boiled until nothing is left but the clean radula. The radula can then be washed and mounted, the best medium for the purpose being glycerine jelly, which should be run in under the cover-glass after the latter has been clipped over the specimen. Air bubbles can be removed by a momentary boiling and the specimen should then be left for some weeks after which the superfluous jelly may be cleaned away and the slide finished by ringing, first with microscope cement and then with gold size.

The author would be glad to furnish further notes on preparing and mounting specimens to anyone who should be interested in the subject or to prepare examples for the Society from any fresh material that may come to hand. The material cannot be too common or apparently insignificant, for instance, *Planaxis sulcatus*, which is very common and has a most unattractive shell, furnishes us with one of the most beautiful radulæ.

It should be noted that many of the radulæ are particularly beautiful objects when viewed with the polariscope.

NOTES ON INDIAN BUTTERFLIES.

BY

CAPTAIN W. H. EVANS.

In the following notes, which will appear in the Journal from time to time it is proposed to give brief notices of any information published regarding Indian butterflies, also the results of my own observations and those communicated to me by other Collectors.

1. Occurrence of **Una usta, Dist.** in Burma. Mr. E.V. Ellis obtained three males of this insect in November 1912 at Maymyo. *Una usta* was described from Malacca, *vide* De Nicéville's Butterflies of India, Vol. III, footnote, page 51. Col. Tytler has recorded it from the Naga Hills.

2. **Azanus ubaldus, Cr.** and **uranus, But.** Bingham thought that these two butterflies would prove to be seasonal forms of the same species. Major H. F. Thuillier at Ahmednagar in November 1912 and Major H. D. Peile at Peshawar in December 1912 found the two forms flying together commonly. There is, I think, no doubt that the two forms are perfectly distinct.

3. **Parhestina jermyni, Druce**, Trans, Ent. Soc. 1911, page 187. This new butterfly is described from two examples caught by Col. T. Jermyn during June 1906 in the Tons Valley near Mussoorie at 4,000 and 7,000 feet elevation. The butterfly is a striking mimic of *Aporia agathon phryxe*, Bdv. It is greenish white with black veins; the black colouring over the veins increases in width towards the termen amalgamating to a row of elongate subterminal spots between veins 4 to 7 on the forewing. The hindwing is angled at vein 4 and cut square to the dorsum. The butterfly is probably a form of *mena*, Moore, if it is not the same insect: the habitat of *mena* is unknown. The Chinese *viridis*, Leech is no doubt conspecific with *mena*, but certainly represents a distinct race. *Nicevillei*, Moore is also conspecific with *mena* and differs chiefly in the far greater extent of the black colouring on the hindwing; it has only been recorded from Dalhousie. It seems probable that we have to deal with a very variable insect, wherein it resembles its prototype *agathon*, and that the Indian forms will eventually stand under the name *mena* with two races, *viridis* and *nigrivena*, Leech from China.

4. A revision of the genus **Lycænopsis** (late *Cyaniris*), based on an examination of the male genitalia. Dr. T.A. Chapman, P.Z.S., 1909, Vol. I, page 419. As the type of *Cyaniris* is *Lyæna semiargus*, Rott. the name must be abandoned and Felder's *Lycænopsis*, type *haraldus*, Fab., adopted. Moore gives the type of *Cyaniris* as *argiolus*; it seems a pity to abandon the well established name of *Cyaniris* on the grounds given. It is remarked that though the facies above of the various species affords no reliable indication of identity, yet the spotting below, when not obsolete, differs constantly in the various species. Attention is drawn to the remarkable mimetic variation in *limbata* and *argiolus*.

Three Indian species are separated from *Lycænopsis* under the name *Notarthrinus*, type *vardhana*, M. as the male organs possess the movable hook present in most *Lycænidæ* but absent in *Lycænopsis*. Besides *vardhana* this new genus comprises *musina*, Snell and *binghami*, Chap. The Indian form of the Javan *musina* has been separated by Swinhoe as *musinoides*; it has been found commonly by Col. Tytler at Manipur. *Binghami* has been described from Assam; it closely resembles the wet season form of *jynteana*, but the dark border at the apex of the forewing is about as wide as in *puspa* and continues at the same width throughout the outer margin of both wings. Col. Tytler obtained a specimen, of what I identify as *binghami*, in the Naga Hills.

Chennellii, DeN. is placed in the new genus *Bothrinia*, first called *Bothria*, but the name was found to be pre-occupied. In *Bothrinia* the clasp is as in *Everes*, the neuration as in *Zizera* and the facies as in *Lycænopsis*.

The Indian species of *Lycænopsis* are given as: (1) *transpecta*, M. (2) *oreas*, Leech, (3) *puspa*, Hors. (= *cyanescescens*. DeN.), (4) *argiolus*, L.(= *huegeli*, M. *coelestina*, Koll., *victoria*, Swinh, and *sikkima*, M. (5) *albidisca*, M. (6) *marginata*, DeN., (7) *limbata*, M. (= *placida*, DeN. and *jynteana*, DeN.), (8) *dilectæ*, M. (9) *lanka*, M. (10) *akasa*, Hors. (11) *melaena*, Doh., (12) *singalensis*, Fd., (13) *albocærulea*, M. *Lilacea*, Hamp. is not mentioned.

Oreas is a Chinese insect and the Indian form, of which there are a few specimens from the Khasi Hills in the British Museum, has been separated by Swinhoe as *oreana*. It is equal in size to *huegeli* and *singalensis* and may be recognized by the four discal spots on the underside of the hindwing being in a regular line, large, prominent and well separated from the others.

Huegeli, *cælestina* and *sikkima* are said to be paralleled by *limbata*, *placida* and *jynteana*: *limbata* forms can always be separated by the third spot on the underside of the forewing being slightly oblique. The following *argiolus* forms are described; *puspargiolus* from Assam mimicking *puspa*; *bothrinoides* flying with and mimicking *chennellii*; *albocæruleoides*, locality not given, mimicking *albocærulea*. These all appear to be dry season forms; the last named agrees with the dry seoson form from the Naga Hills. In my list of Indian butterflies, J. B. N. H. S. XXI, 982, I have pointed out that *jynteana*, De Nicèville's and Moore's types, are forms of *argiolus* and not of *limbata*.

Singalensis is said to only occur in Ceylon, Java and Sumatra.

The paper is illustrated with excellent photographs of the genitalia of the various species dealt with.

I have generally followed Dr. Chapman's arrangement in my list, but have retained the name *Cyaniris* and have placed his new genera as sub-genera.

5. Revision of the **Zizeeriidæ** based on an examination of the male genitalia. Dr. T. A. Chapman, Trans. Ent. Soc. 1910, 479. Moore in describing *Zizera* gave as his type *alsus* though intending the genus for *karsandra*, *gaika* and *indica*. Dr. Chapman states that *alsus* is very different to these three forms and, as the name *Zizera* must therefore be abandoned, proposes to replace it by *Zizeeria*, type *karsandra*, M. In Seitz's Palæarctic Lepidoptera, *minima*, Fuess (=*alsus*, W. V.) still figures under *Zizera* and so Dr. Chapman's reasons for abandoning the name are not altogether clear.

The group included heretofore under *Zizera* are called the *Zizeeriidæ* and are split up as follows :

(1). *Zizeeria*, type *karsandra*, M.; other species *lysimon*, Hub., *maha* Koll, *ossa*, Swin. Clasps soldered together for some distance basally extremities broad and furnished with bold teeth.

(2). *Zizina*, type *labradus*; other species *sangra*, M. and *indica*. Mur. Clasps only slightly soldered together, terminal teeth minute, a solitary hair, thick and clubbed arising close to the base.

(3). *Zizula*, type and only known species *gaika*, Fab. Forewing vein 11, joining vein 12 and not again separating from it, *i.e.*, it forms merely a bar from the cell to vein 12. Clasps as *Zizina*.

Lysimon is the European and African form: *karsandra* the Asiatic form. On the forewing below the discal row of spots in *lysimon* are small, even and slightly curved; in *karsandra* these spots are large, of varying size and in a much bent row.

Maha=*diluta*, Fd., *chandla*, M. *squalida*, But., *opalina*, Pouj, *marginata*, Pouj., *albocæruleus*, Rob. *argia*, Men, *japonica*, Mur., *alope*, Fenton. Perhaps some of these may=*ossa* and even be prior to it. The distribution of *maha* and *ossa* is not given: according to Swinhoe *ossa* is the form from Southern India and Ceylon, while *maha* is the form from the remainder of the region inhabited by the species. The genitalia are very similar, but in *maha* the clasps are longer and more slender.

Sangra is a form of *labradus* from South Polynesia and Australia. The identification of *otis*, Fab., is doubtful and it may equal *indica* or *sangra*. *Sangra* is the form from North India; Burma the Andamans and Nicobars; *indica* from Ceylon and India South of Lucknow. The spots on the forewing below are small and uniform, while in *indica* they are large and irregular. On the hindwing below in *sangra* the second spot from the costa is so placed that a line joining the first and second spot would, if continued, pass close to the discal line and strike the sixth spot; in *indica* these spots are less basal and this line would meet the fourth spot.

It is worthy of note that, as regards the markings below, *indica* differs from *sangra* in exactly the same way as *ossa* does from *maha* and *lysimon* from *karsandra*.

I had not seen this paper when compiling my list of Indian butterflies. I consider that the name *Zizera* should be retained and possibly *Zizina* and *Zizula* adopted as subgenera; the Indian form of *lysimon* should be regarded as *lysimon karsandra*: there seems no reason why, at any rate, until Fabricius's type is discovered, the name *otis* should be discarded in favour of *sangra*.

6. A note on certain butterflies in the collection of Mr. Ollenbach of Dehra Dun.

Mr. Ollenbach has very kindly sent me an oil painted plate from which the following notes are taken. Amongst them are three species new to India. It is, of course, dangerous to attempt to identify insects from figures only, but in this instance there is no room for doubt as to the particular species represented, though whether they happen to be local races of the first named form is another matter.

(*a*) **Papilio alexanor, Esp.** A male and female obtained in April 1905 at a height of 4,300 feet on the road between Quetta and Nushki in Baluchistan, flying in company with *Hypermnestra helios*. The specimens do not appear to differ from typical *alexanor*, which flies in Southern Europe and is certainly nearer to it than to the Persian race, *orientalis*, Rom. The butterfly belongs to the same sub-genus as *machaon* and resembles it as regards the yellow ground colour; the wings are crossed by broad black bands, *viz.*, a sub-basal band across both wings, beyond which are two subcostal bands on the forewing and one at the end of the cell on the hindwing, followed by a submarginal and narrow marginal band; the base of the forewing and the dorsal margin of the hindwing for two-thirds of its length are narrowly black.

(*b*) **Papilio neptunus, Guer.** caught at Tavoy, Burma, in June 1912. The butterfly was described from Malacca and inhabits also Borneo, Sumatra and Nias. It is a member of the *coon* group, possessing the spatulate, slender shafted, tail characteristic of the group, of which the Indian *doubledayi* and *rhodifer* are members. It is black above with paler patches between the veins of the forewing as in the forms of coon; the hindwing bears a discal series of somewhat elongate red spots in interspaces 1 to 4. The breast is red at the sides and the abdomen greyish yellow from the middle.

(*c*) **Hypolimnas antilope anomala, Wall** a female caught in the Nicobars in June 1912. *Antilope*, Cr., was described from the Moluccas, but the butterfly occurs in a number of forms from Sumatra to the Fiji Islands. The

Westerly race is *anomala* and to this form belongs the female in Mr. Ollenbach's collection. The butterfly resembles the dry season female form of *bolina*, but is somewhat smaller; the ground colour is black with, on both wings, a subterminal row of small white spots in each interspace followed by a terminal row of two minute white spots in each space; there are also three obscure long white dashes between the cell on the forewing. The female is shot with brilliant blue all over the forewing. This is one of the few species in which the female is more brilliantly coloured than the male.

(*d*) The following records of butterflies caught in Chinese Turkestan may prove of interest:

Mesapia peloria, Hew, a rather pale form and **Coenonympha sinica, Alph.** Suchow, 9,500 feet, August 1907.

Parnassius actius caesar, Stg., near ab **actinobolus, Stg.,** and **szechenyi, Friv.** Uch Turfan, 9,000 feet, July 1907.

Colias cocandica, Ersch, a rather dark specimen, Hindutash Darwan 14,500 feet, July 1907.

(*e*) A specimen of **Papilio memnon agenor, L.,** female form **agenor** with all the white markings much developed; the whole of the hindwing and the lower portion of the forewing are entirely white. It resembles the form *venusia* described by Dr. Jordan from Borneo. The specimen was caught in the Khasi Hills in September 1906.

(*f*) A specimen belonging to the genus *Euthalia* (*Dophla*), probably a female. The forewing resembles exactly the forewing of *sahadeva* female while the hindwing is an exact copy of the hindwing of *duda* female. Were this the only specimen known, one would take it for a hybrid, but Colonel Tytler has obtained, in the Naga Hills, several males and females similarly marked and so it may be taken to represent a new species intermediate between *duda* and *sahadeva*. Colonel Tytler has informed me that he intends to describe his specimens. Mr. Ollenbach's specimen was taken in the Khasi Hills in October 1906.

(*g*) Two aberrations or possibly extreme dry season forms of **Pareronia hippia, Fab.,** males taken near Dehra Dun in October 1909. The marginal band on the fore wing is very reduced and there are no spots on the ground colour enclosed. Mr. Ollenbach informs me that the head, thorax and abdomen are covered with white down and the veins and marginal markings are pale brown.

7. Occurrence of **Ypthima philomela, Joh.** in lower Burma. Mr. E. V. Ellis has just sent me a long series of the dry season form of this species caught at Yetho near Tharrawaddy during February 1913. In size the specimens resemble the South Indian form; above the bi-pupilled ocellus on the forewing and the two ocelli on the hindwing are bright and clearly defined as in race *indecora* from the Western Himalayas. Below they resemble the dry season form of *inica*, but, when visible, the ocelli are arranged as in *philomela*; there are traces of a discal band on the forewing and of a discal and sub-basal band on the hindwing.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA.

BY

KATHLEEN V. RYLEY.

With Field Notes by the Collector, G. C. SHORTRIDGE.

COLLECTION ... ... No. 9.
LOCALITY ... ... MYSORE.
DATE ... ... SEPTEMBER-NOVEMBER 1912.
COLLECTED BY ... ... MR. G. C. SHORTRIDGE.
EARLIER REPORTS .. .. No. 1, E. Khandesh, Vol. XXI, p. 392, 1912; No. 2, Berars, Vol. XXI, p. 820, 1912; No. 3, Cutch, Vol. XXI, p. 826, 1912; No. 4, Nimar, Vol. XXI, p. 844, 1912; No. 5, Dharwar, Vol. XXI, p. 826, 1912; No. 6, Kanara, Vol. XXI, p. 29, 1913; No. 7, Central Provinces, Vol. XXII, p. 45, 1913; No. 8, Bellary, Vol. XXII, p. 58, 1913.

The State of Mysore lies between 11°-38′ and 15°-2′ N. lat. and 74°-42′ and 78°-36′ E. long. This collection however was principally made in the South and East of the State as a camp had been made before in the North at Shimoga, the result of which was included in the Kanara collection and therefore this collection may practically be said to have been made South of about 13°-20′ N. lat.

Mysore can be divided in two natural areas, the "Mulnad" or hill country on the west, bordering and on the Western Ghats, and the "Maidan" or open country which is roughly that area lying to the East of a line from Shikarpur to Periyapatna. The "Mulnad" consists of hills covered with forest, principally evergreen, which gives place higher up to open downs and scattered trees topped frequently by bare craggs. On the hill sides much clearing has been done for Coffee plantations and in the valleys, rice, &c., is cultivated, The "Maidan" country is more varied and is heavily cultivated in the valleys, where the black alluvial soil is found. On the higher parts the red soil takes the place of the black and various grain crops are grown there, but much of it is under grass and on the dryer parts a considerable area is covered with scrub jungle.

The following descriptions are sent by Mr. Shortridge:—

"*Bangalore.*—Altitude 3,113 feet; average rainfall 36 inches; mean temperature 76°·2. Flat, red, sandy country, entirely under cultivation. The city itself covers an area of 20 square miles, the residential part being composed largely of detached bungalows surrounded by well timbered grounds. The present collection was obtained in the compound of the Deccan Horse Mess.

Kolar Town.—About 11 miles to the North of Bowringpet Station, near the Kolar Gold Fields, in the district of the same name. Altitude 2,786 feet with rocky granite hills rising up behind the town to an altitude of 4,026 feet, with the exception of these hills, which form quite an isolated patch, the country is quite flat, with red sandy soil. The district is naturally almost treeless, but trees have been planted very extensively in the district, and besides fringing the roads, there are a considerable number of 'casuarina' and other plantations. The rainfall is less than around Bangalore.

Malur.—About fifteen miles West of Kolar Town, Kolar District.

Nundydroog.—About 35 miles North-West of Kolar Town.

Coromandel.—About 10 miles South-East of Kolar Town. Kolar Gold Fields.

Seringapatam.—About 10 miles from Mysore City. Altitude 2,338 feet, situated on an island between two branches of the Cauvery river. The island is almost flat and entirely under cultivation, which consists chiefly of rice, well wooded with cocoanut palms, wild fig, mango trees, etc.

"*French Rocks.*"—A group of bare rocky hills about two miles to the North of Seringapatam.

Sivasamudram (Cauvery Falls).—About 40 miles to the East of Mysore City, on the North bank of the Cauvery river, which here forms the boundary between Mysore State and Coimbatore. Altitude about 2,500 feet. Country very hilly and rocky in places, and except where there are patches of cultivation, very evenly covered with thick scrub jungle. On the Coimbatore side of the river the scrub is higher, while there are also patches of big forest and bamboo jungle.

Among the larger mammals occurring in the district are Sambar, Chital, Four-horn Antelope, Bear, Panther, Tiger (rare) and Pig. *Simia sinica* was fairly plentiful, and a 'Langur' said to exist on the Coimbatore side of the river, is very probably '*Presbytis priamus*;' otters occur in the river but are said to be rare and seldom seen.

While in Mysore State, I received much assistance from the local officials, while H.H. the Maharaja was kind enough to grant me a free license as well as permission to shoot in State forests."—G. C. S.

The Collection includes 458 specimens, belonging to 37 species in 27 genera.

A large and representative series of the Mysore Slender Loris was taken, also a great number of Bats representing 16 species. Six Domestic Cats were obtained and it will be interesting to compare the specimens from different villages in various parts of the country. The Rodents include a large series of *Funambulus palmarum* and a number of *Cremnomys cutchicus*, which appears to be very common in Mysore State. There was also one *Leggada* which does not seem to agree with any of the previously described forms; it resembles *L. cinderella* in some respects, but has rather a longer nose and redder fur, and as *cinderella* was collected in Cutch, this one is probably a different form.

Simia sinica, L.

The Bonnet Monkey.

(Synonymy in No. 5.)

♂ 1898. Kolar, E. Mysore.

(*See* also Reports Nos. 5, 6 and 8.)

"Very plentiful at Kolar. Here, as in many other places, owing to the protection afforded them by the Hindoo villagers, they have practically lost all fear of men, hardly making way for people when in the streets. Large numbers of them live in the towns and villages, where they often do a lot of damage to houses by pulling off the tiles, for which reason the roofs are frequently covered with thorny branches to keep them off; while they constantly raid shops where food is kept, but apart from this they do not, in a free state, seem to develope the same inquisitive and vicious habits, that caged specimens so often do. It is noticeable that in forest country both this Monkey and the Langur are comparatively much shyer animals. No species of Langur occurs in Eastern Mysore so that I may have crossed the South-Eastern limit of *Presbytis hypoleucus*."—G. C. S.

Loris lydekkerianus, Cabr.

The Mysore Slender Loris.

1888. *Loris gracilis* Blanford. Mammalia No. 27. (Partim)
1904. *Loris gracilis* (typ. var.), Lydekker, P.Z.S.; p. 345.
1908. *Loris lori lydekkerianus*, Cabrera. Bol. R. S. Espan; Hist. Nat. p. 211.
♂ 1899. ♀ 1900, 1901, 1902. Kolar, East Mysore.
♂ 1911, 1913, 1914, 1915, 1916, 1917, 1918, 1923.
♀ 1912, 1919, 1920, 1921, 1922, Malur.
♂ 1974, 1975, 1978, 1979, 1980. ♀ 1976, 1977, Nundydroog.

Vernacular names:—Kada-Papa, Adavi-Papa (Kanarese); Wanur-Manushya (Marathi); Arawe-Papa (Telegu); Kattu-Papa, Kattu-Pullaye (Tamil); Sherminda (Dekhani and Hindustani).

"*Loris tardigradus* is not the *Nycticebus tardigradus* of the "Mammalia" No. 26, which is the slow Loris of Malaysia, Mr. Thomas has shown in the A.M.N.H. for 1908 (p. 468) and again in the P.Z.S. for 1911 (p. 129) that the name *tardigradus* was undoubtedly given by Linnæus to the Ceylon Lemuroid.

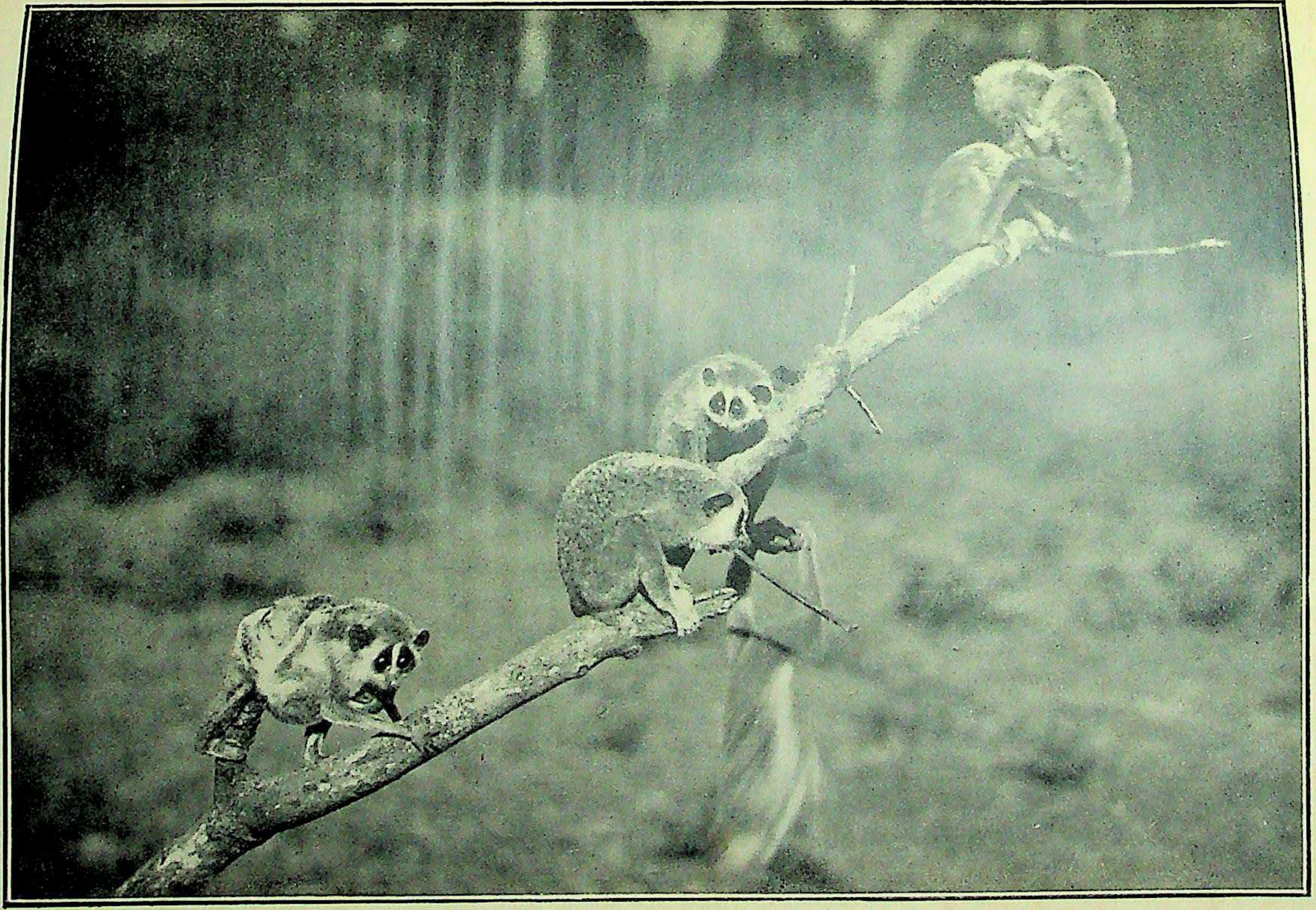
Blanford, in common with most systematists of the 19th Century, is in error in following Geoffroy, who in 1796 (Mag. Encycl., Vol. I., p. 48.) transferred the name, without authority, from the long-armed Slender Loris, to the short-armed Slow Loris, and established the name *gracilis* for the former. The name *gracilis*, as well as *lori*, *ceylonicus*, *zeylanicus*, all having been given to the Ceylon animal, must rank as synonyms of *tardigradus*.

The earliest name for the Slow Loris, as shown by Stone and Rehn (Proc. Acad. Nat. Sci. Philadelphia, 1902, p. 141) is *coucang*, Boddaert, (Elench. Anim., p. 67, 1783) with the type locality 'Bengal.' In the same paper they propose to adopt also Boddaert's name *Tardigradus* for *Loris*, but Palmer has pointed out (Ind. Gen. Mamm. 1904) that that name is preoccupied by Brisson for an Edentate. The name *Nycticebus coucang*, Bodd, must therefore be used for the animal dealt with under No. 26 in the 'Mammalia.'

In 1904, Lydekker (l.c.) separated the Ceylon and Mainland forms, on colour differences, and four years later Cabrera (l.c.) gave the name *lydekkerianus* to the Madras form. The mounted specimen, mentioned by Lydekker, is the only one from Ceylon available to us for examination, so that unless, and until, a series from Ceylon is obtained to show that the colour differences, relied on by Lydekker are not constant, the name we have here used must stand for the Madras Slender Loris, and all the names mentioned above except those in the synonymy, must be relegated to the synonymy of the Ceylon Slender Loris."—R. C. W.

" Pupils vertical and almost perpendicular. The upper points inclining slightly inwards, in a strong light they contract, to a very small size. At night when the pupils are fully expanded they shine with a very bright golden-copper light. Irides bright chestnut ; bare skin on snout deep reddish flesh colour ; insides of ears bright yellow. All of these specimens were kept alive for various lengths of time ; in some respects they showed very little intelligence and if irritated one would generally make for and bite its nearest neighbour ; some that were kept in a small room if teased would even walk across to the other side in order to attack another that might be in an other corner ; while an angry female would even vent its rage on its own young, which would chatter and bite back but never let go its hold. Even when first caught they do not appear much frightened, and if carefully handled, would seldom attempt to bite unless their faces were touched. When in a cage, dogs would occasionally come up and bark at them, when they would get up close to the wires of the cage and growl back apparently without any fear whatever. If watched closely they would generally crawl away, or, if in a tree, attempt to conceal themselves among the leaves, or if that were impossible, they would occasionally hide their faces between their forepaws, which was their usual position when asleep ; on account of this habit, it has got its Hindustani name *Sherminda* (shy animal).

When in a tree, especially among foliage, they bear a striking resemblance to the spotted owlet (*Athene brama*), which was very plentiful in the district, and they have the owl-like habit of swaying their heads from side to side, besides the noise they make, especially when fighting, is almost identical to the screech of this owl, except that it is perhaps not quite so loud. The only other sounds I have heard them make is a faint chattering noise rather like that of a monkey, and a kind of low growl that is uttered when irritated. The young, even when three parts grown, would cling by day to the female so tightly that she would often appear half suffocated. The pale, silky appearance of the fur on the hind parts of the females is probably due to the constant clinging on of the young ; at other times it is probably similar in appearance to that of the males. Several females were found carrying two young, so that two at a birth are probably quite usual. If placed on a branch, three, or four feet from the ground, they would occasionally drop to the ground, but were quite incapable of jumping even the shortest distance from one branch to another. They have a very strong power of grip, and when caught would grab at anything within reach. Although their movements were as a rule slow and deliberate, they were much less so, than those of *Nycticebus*, and at night when on the ground they could run about at qute a respectable pace, displaying a considerable amount of cunning in trylin to escape or hide away when they were not being watched ; their movements on the ground being exactly like those of a monkey when walking slowly. They must frequently travel considerable distances on the ground, as they must have done to have existed around Kolar, where most of the trees have been planted, while there are large stretches of quite



Mysore Slender Loris (*Loris hydekkerianus*).

open country between that town and any real forest country. From its evident abundance in the Kolar district it would seem to be an animal that is not confined at any rate to heavy forests. They appear quite unable to swim and when placed in water would strike out alternately with each leg in a helpless way without making any headway. They are extremely pugnacious, and when several were kept together, would fight and keep up a continual squeaking throughout the day and night, while every day one or more would get killed, probably more from exhaustion than anything else. Their method of fighting was very peculiar; it consisted of gripping each other by the fur of the head, in order to keep the other's head away, and then biting each other on the feet and hands, drawing blood freely. If kept alive for any length of time they would have to be kept separately, or in a very large enclosure. They fed freely on cooked rice and bananas, and were especially fond of grasshoppers, which they would hold in one hand and take bites from. They are said also to feed largely on small lizards and other insects."—G. C. S.

These Lorises and those received later from Coorg indicate that, besides the grey form described as *Loris tardigradus lydekkerianus* to which these belong, there is also in S. India a representative of the form *L. tardigradus.* The two forms differ not only in colour, as hitherto supposed, but also by the size of their skulls; and I, therefore, think they should be recognised as distinct species, a conclusion in which Mr. Thomas agrees with me.

The following are the dimensions of good examples of *Loris lydekkerianus* (No. 1922) and of *Loris tardigradus* from Coorg (No. 2586), the latter is perhaps rather less aged than the former.

Dimensions.—Head and body 245 (216); hind foot 52 (45); ear 31 (25).

Skull.—Greatest length 55 (48), Condyle to front of canine 45·5 (40·3); back of m^3 to front of canine 18 (15·5); combined inter-orbital breadth 33·4 (32·4); breadth across m^2 (from the outside) 17 (15·5); mastoid breadth 33·8 (29·4).

Dimensions of Coorg specimens in brackets.

PTEROPUS GIGANTEUS, Bruenn.

The Common Flying Fox.

(Synonymy in No. 2.)

♂ 1769, 1770, 1772, 1773, 1775, 1776, 1777, 1778, 1868.
♀ 1768, 1771, 1774, in al ♀ 1794 (head only). Kolar, E. Mysore.
♂ 2000, 2081. Seringapatam, S. Mysore.

(*See* also Reports Nos. 2, 3, 4, 5, 7 and 8.)

CYNOPTERUS SPHINX, Vahl.

The Southern Short-nosed Fruit Bat.

(Synonymy in No. 6.)

♀ 2043. Seringapatam, S. Mysore.

(*See* also Report No. 6.)

"Not very plentiful at Seringapatam. This species, unlike the large 'Flying Fox' seldom clings to the trees while feeding; nearly always biting at a fruit while in flight, and devouring it on the wing. Its presence in a district is not always easy to detect as it appears late in the evenings and its flight, which is comparatively swift, is not unlike that of the larger insectivorous bats."—G. C. S.]

Lyroderma lyra, Geoff.

The Indian Vampire Bat.

(Synonymy in No. 1.)

♂ 1854, 1885. ♀ 1851, 1852, 1853, 1855, 1883, 1884, 1886, 1887, 1888, 1889, 1890. Kolar, E. Mysore.
♂ 1930, 1932, 1933. ♀ 1931, Seringapatam, S. Mysore.

(*See* also Reports Nos. 1, 4, 5, 6, 7 and 8.)

The Kanarese name 'Kankapata' or 'Kapata' means 'deceit' or "something that appears to be what it is not."

"I have been given the following Kanarese legend about the temple dwelling bats—from Kolar. According to the legend, bats were once birds, but becoming dissatisfied they began coming to temples in order to pray that they might be made like men; and one day they actually did change, but only partly so, becoming nondescript animals, still partly like birds, but with the teeth and faces of men. Being then ashamed to meet other birds, they only went about by night, but still they come to the temples by day, although now to pray that they may once more be changed into birds again."—G. C. S.

Rhinolophus rouxi, Temm.

The Rufous Horse Shoe-Bat.

(Synonymy in No. 5.)

♂ 1924, 1942. ♀ 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963 1964, in al. 1965, 1966, 1967, 1968, 1969, 1970. Seringapatam, S. Mysore.

(*See* also Reports Nos. 5 and 6.)

"In the 'Report' on the Dharwar collection, it was suggested that the colour 'phases' of some bats might be analogous to the white and dark bellied forms of "*Epimys rufescens.*" The present series, however, shows pretty clearly that the bright rufus colouring of the fur of this species at least is not peculiar to individuals, but a temporary coat which is in all probability seasonal. (I doubt if it has anything to do with the breeding season.) In a large number of this series, the red fur is evidently being 'moulted.'

I think that there is very little doubt that the red and grey bats represent the hot and cold season moults; in the present series the grey coat, that is being assumed, would seem to belong to the coming 'hot season.' I suggest, however, that the cold season moult, although normally of a varying shade of rufus is not invariably assumed, which would account for rufus or grey individuals of either sex occurring at all seasons."—G. C. S.

Hipposideros lankadiva, Kel.

The large Indian Leaf-nosed Bat.

(Synonymy in No. 6.)

♂ 1747, 1875, 1903, Kolar, E. Mysore.

(*See* also Reports Nos. 6, 7 and 8.)

HIPPOSIDEROS DUKHUNENSIS, Sykes.

Sykes' Leaf-nosed Bat.

(Synonymy in No. 5.)

♂ 1862, 1863, 1865, 1866, 1871, 1872, 1873, 1879, 1880.
♀ 1783, 1784, 1864, Kolar, E. Mysore.
♂ 2014, 2015, 2016, 2118, 2019, 2022. ♀ 2017, 2020, 2121, 2123. Seringapatam, S. Mysore.
♂ 2069, 2145, 2186, 2139. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 5, 6 and 8.)

"Plentiful around Seringapatam and Sivasamudram. A low but not a particularly late flier."—G. C. S.

HIPPOSIDEROS FULVUS, Gray.

The Bicoloured Leaf-nosed Bat.

(Synonymy in No. 3.)

♂ 1909. Coromandal, E. Mysore.
(*See* also Reports Nos. 3, 5, 6, 7 and 8.)

PIPISTRELLUS CEYLONICUS, Kel.

Kelaart's Bat.

(Synonymy in No. 1.)

♂ 1729. ♀ 1698, 1709, 1728, 1731. Bangalore, E. Mysore.
♂ 2034. Seringapatam.
♂ 2075, 2076, 2080, 2081, 2087, 2089, 2091, 2139.
♀ 2074, 2077, 2078, 2079, 2099, 2100, 2101, 2105 2106, in al, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2107, 2108. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 2, 3, 5, 6 and 8.)

PIPISTRELLUS MIMUS, Wrought.

The Southern Dwarf Pipistrelle.

(Synonymy in No. 1.)

♂ 1696, 1727. Bangalore, E. Mysore.

(*See* also Reports Nos. 1, 2, 3, 5, 6, 7 and 8.)

PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrelle.

(Synonymy in No. 5.)

♂ 1697. Bangalore, E. Mysore.
♂ 2131. ♀ 2129, 2130, imm. Sivasamudram, S. Mysore.

(*See* also Report No. 5.)

KERIVOULA PICTA, Pall.

The Painted Bat.

(Synonymy in No. 5.)

2051 in al. Sivasamudram, S. Mysore.

(*See* also Report No. 1.)

"Without doubt a late flier. In an immature specimen from Java, the interfemoral membrane, as well as the wings, was mottled with black.

The Southern Indian specimens differ considerably from the Javanese in colour, the bright orange red of the wings being in Java of a deep yellow with hardly a trace of orange."—G. C. S.

SCOTOPHILUS KUHLI, Leach.

The Common Yellow Bat.

(Synonymy in No. 1.)

♀ 1717, 1725, 1726. Bangalore, E. Mysore.
♂ 1882. ♀ 1881. Kolar, E. Mysore.

(*See* also Reports Nos. 1, 3, 5, 6 and 7.)

SCOTOPHILUS WROUGHTONI, Thos.

Wroughton's Bat.

(Synonymy in No. 1.)

♂ 1858. Kolar, E. Mysore.
♀ 1999. Seringapatam, S. Mysore.

(*See* also Reports Nos. 1, 5, 6 and 7.)

"Fairly plentiful around Seringapatam. An early and a very swift flier."—G. C. S.

TAPHOZOUS KACHHENSIS, Dobs.

The Cutch Sheath-tailed Bat.

(Synonymy in No. 1.)

♂ 2053. ♀ 2052, 2054. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 3 and 8.)

"A small colony of this species was discovered in the roof of the Electric power station at Sivasamudram."—G C. S.

TAPHOZOUS LONGIMANUS, Hardw.

The Long-armed Sheath-tailed Bat.

(Synonymy in No. 6.)

♂ 1817, 1849, 1850, 1859, 1860, 1895. Kolar, E. Mysore.

(*See* also Reports Nos. 6, 7 and 8.)

NYCTINOMUS TRAGATUS, Dobs.

Dobson's Wrinkle-lipped Bat.

(Synonymy in No. 3.)

♂ 1812, 1840. Kolar, E. Mysore.

(*See* also Reports Nos. 3 and 5.)

PACHYURA, sp.

Shrews.

♂ 1700. ♀ 1699, 1701. Bangalore, E. Mysore.

(*See* also Reports Nos. 1, 3, 4, 5, 6 and 7.)

FELIS PARDUS, L.

The Panther.

(Synonymy in No. 5.)

1815, 1904. Kolar, E. Mysore.

(*See* also Reports Nos. 5 and 6.)

"No. 1815 must have been an exceedingly large panther, and, although apparently not much stretched, its head and body alone measures 5 ft. 9 ins., its entire length is 8 ft. 6 ins., but at least a foot of its tail has been broken off. It is considered remarkably large here, and it would have been interesting to have known its measurements in the flesh.

No. 1904 is said, by the natives who caught it, to have been adult, and an example of the small, so called dog-panther, but it appears to me to be without doubt an immature specimen."—G. C. S.

Felis (domestic).

♂ 1816, 1838, 1869, 1891, 1893. ♀ 1892. Kolar, E. Mysore.

"These specimens are the typical domestic village cat of the Dekhan. There seems to be very little variation in their markings, except as to the extent of white on their limbs and underparts."—G. C. S.

Canis indicus, Hodgs.

The Common Indian Jackal.

(Synonymy in No. 1.)

♀ 2112, 2136. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 3, 4, 5, 6 and 7.)

Mungos mungo, Gmel.

The Common Indian Mongoose.

(Synonymy in No. 1.)

♂ 1973, 1998. ♀ 1972, 1997. Seringapatam, S. Mysore.

(*See* also Reports Nos. 1, 2, 3, 4, 5, 7 and 8.)

"The common mongoose around Seringapatam; this species was also identified at Sivasamudram."—G. C. S.

Funambulus palmarum, L.

The Palm Squirrel.

(Synonymy in No. 2.)

♀ 1708. Bangalore, E. Mysore.
♂ 1861. ♀ 1785, 1896, 1897. Kolar, E. Mysore.
♂ 1906, 1907. ♀ 1907, 1908. Kolar Town, E. Mysore.
♂ 1982, 1984, 1985, 1986, 1987, 1988, 1990, 1991, 1993, 2003, 2004, 2005, 2007, 2012, 2013. ♀ 1983, 1989, 1992, 2002, 2006. Seringapatam, S. Mysore.
♂ 2145. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 2, 4, 5, 7 and 8.)

"Not very plentiful around Bangalore, but it is said to have died off in large numbers during the last Bubonic plague epidemic, although it is curious that it does not appear to die off in all plague striken localities. Very plentiful around Kolar."

Existing in what appeared to be abnormal numbers around Seringapatam."—G. C. S.

Tatera indica, Hardw.

The Indian Gerbil.

(Synonymy in No. 1.)

♂ 1797, 1799. ♀ 1798, 1800, 1830, 1831. Kolar, E. Mysore.
♂ 1994, 2011. ♀ 1995, 1996, 2008, 2009, 2010, 2024. Seringapatam, S. Mysore.
♀ 2124, 2138. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 2, 4, 5, 6, 7 and 8.)

Kanarese (of Kolar) Kardilli.

Cremnomys cutchicus, Wrought.

The Cutch Rock Rat.

(Synonymy in No. 3.)

♂ 1757, 1759, 1761, 1763, 1764, 1765, 1876. ♀ 1758, 1760, 1762, 1877, 1878, 1894. Kolar, E. Mysore.
♂ 2025, 2026, 2027, 2028, 2033, 2037, 2039. ♀ 2029, 2035, 2036, 2038, 2040, 2041, 2042. French Rocks, Near Seringapatam.
♂ 2046, 2072, 2082, 2083, 2095, 2116, 2125, 2135. ♀ 2044, 2045, 2047, 2048, 2049, 2071, 2084, 2123 in al. ♂ 2096. ♀ 2050. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 3 and 8.)

"Very plentiful among the rocky hills near Kolar, and from the number of bones found in their pellets, this species must be preyed upon by owls. The granite hills, on which this species was obtained, cover a considerable area to the West of Kolar Town, and are quite isolated, although there are several similar but smaller patches visible to the North and North-East.

They are quite similar to the rocky hills around Vijayanagar. I think this may be the South-Eastern limit of *Cremnomys*, as to the South, the grass and jungle covered slopes of the hills, that culminate in the Jawadi hills and Shevaroys, are visible, the country between being quite flat, but it may occur a little further South, in a Western direction."—G. C. S.

"Plentiful at 'French Rocks'— the hills are bare and rocky, very similar to those around Kolar. Occurring on Chamandi hill close to Mysore City. I was very much surprised to find *Cremnomys* in large numbers at Sivasamudram, as although the hills are rocky, the country (including the hills themselves) is everywhere covered with dense scrub jungle, quite unlike the dry open localities where I had previously obtained this species, while here it was by no means confined to rocky localities. It is astonishing that such a plentiful and widely distributed species as this should have remained so long undiscovered."—G. C. S.

Epimys blanfordi, Thos.

The White-tailed Rat.

(Synonymy in No. 2.)

♂ 2141. ♀ 2134, 2140, 2143, 2144. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 2, 6 and 7.)

"I was surprised to find, what in South India is such a typically forest species as this, existing in scrub jungle, side by side with '*Cremnomys*.' In North Kanara, I found this rat building nests in hollow trees, often at some distance from the ground. At Sivasamudrum, where the jungle is almost entirely composed of large bushes, its habits are without doubt different."—G. C. S.

EPIMYS RUFESCENS, Gray.

The Common Indian Rat.

(Synonymy in No. 1.)

♂ 1692, 1694, 1695, 1706, 1713, 1716, 1720, 1721, 1736. ♀ 1689, 1702, 1707, 1730, 1733. Bangalore, E. Mysore.
♂ 1786, 1833, 1837. ♀ 1793, 1819, 1836. Kolar, E. Mysore.
♂ 1910. Coromandel.
♂ 1929, 1971. ♀ 1925, 1926, 1927, 1928. Seringapatam, S. Mysore.
♂ 2098, 2114. ♀ 2073, 2097. Sivasamudram, S. Mysore.

VARIETY with white underparts.

♂ 1693, 1704, 1705, 1724, 1734, 1735. ♀ 1712, 1715, 1723. Bangalore, E. Mysore.
♂ 1779, 1780, 1781, 1814, 1818, 1835, 1846, 1856. ♀ 1766, 1782, 1834. Kolar, E. Mysore.
♂ 2056, 2057, 2058, 2113. Sivasamudram, S. Mysore.

(*See* also all previous Reports.)

"I consider the grey and white bellied varieties, obtained around these and other camps near towns and villages, are undoubtedly one species—the Indian domestic form (at one time imported). The frequent appearance of white below makes it probable that the original white bellied jungle form (of which specimens obtained in Kardibetta Forest, Shimoga, are typical) crosses freely with the grey bellied when they meet, and that the pure white bellied form has quite disappeared in the populated districts, those with white bellies merely retaining a persistent character derived from crossings probably of many generations back."—G. C. S.]

"Numbers 2113 and 2114, large specimens with extremely long tails, were trapped in jungle, one specimen has white underparts, and the other dark."—G. C. S.

MUS BOODUGA, Grey.

The Southern Field-Mouse.

(Synonymy in No. 1.)

♂ 1718. Bangalore, E. Mysore.
♀ 2127. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 2, 4, 5, 6, 7 and 8.)

MUS MANEI, Kel.

The Common Indian House-Mouse.

(Synonymy in No. 5.)

♂ 1745, 1746. ♀ 1739, 1740, 1742, 1743, 1744. Bangalore, E. Mysore.
♂ 1750, 1751, 1752, 1791, 1804, 1805, ♀ 1748, 1749, 1753, 1787, 1788, 1789, 1790, 1801, 1802, 1803, 1806, in al. ♂ 1807. ♀ 1808. Kolar.
♀ 2109, 2110, 2111, 2115, 2137. Juv. 2118, 2120, 2121, 2122. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 5, 6 and 8.)

A peculiar thing about *Mus manei* is that it is distinctly local, and although plentiful, and occasionally swarming in most towns and villages, it is sometimes unaccountably rare or even entirely absent."—G. C. S.

LEGGADA PLATYTHRIX, Benn.

The Dekhan Spiny Mouse.

(Synonymy in No. 1.)

♂ 1842. ♀ 1841. 1843 juv. Kolar, E. Mysore.
♂ 2132, 2137. ♀ 2128, 2142. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 2, 4, 5 and 7.)

"The several species of *Leggada* trapped at Sivasamudram may have been plentiful enough, but I found it impossible to get a satisfactory series of any of them, as the enormous numbers of *Cremnomys*, in the district invariably got into the traps to the exclusion of everything else."—G. C. S.

LEGGADA SIVA, Ryl.

The Mysore Leggada.

1913. *Leggada siva*, Ryley. Journ., B. N. H. S. Vol. xxii, p. 241.
♀ 2070. Sivasamudram, S. Mysore.

GUNOMYS KOK, Gray.

The Southern Mole-Rat.

(Synonymy in No. 1.)

♂ 1820, 1822, 1827, 1829. ♀ 1796, 1821, 1824, 1825, 1826, 1827, 1828, 1847, 1848. in al. ♀ 1844, 1845. Kolar, E. Mysore.

(*See* also Reports Nos. 1, 4, 5, 7 and 8.)

BANDICOTA MALABARICA, Shaw.

The Malabar Bandicoot.

(Synonymy in No. 5.)

♂ 1688, 1690, 1691, 1738 juv. ♀ 1703, 1710, 1711, 1714, 1719, 1722, 1732, 1737 juv. 1741 (skull only). Bangalore, E. Mysore.
♂ 1767, 1792, 1813, 1867, 1870. ♀ 1754, 1755, 1756, 1809, 1810, 1811, 1832, 1839, 1857 in al. 1795, 1874. ♀ Kolar E. Mysore.
♀ 2055. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 5, 6 and 7.)

"More plentiful in Kolar town than in any place I have yet visited, also numerous in Bangalore. A number of the specimens obtained at Bangalore, had the hair on the back curiously worn away. I think it is due to those particular specimens having made their tunnels between bricks and hard masonry which they had been unable to enlarge sufficiently. The reddish hairs on the backs of many bandicoots are probably due to insufficient colouring matter in hairs that are continually being worn away."—G. C. S.

HYSTRIX LEUCURA, Sykes.

The Indian Porcupine.

(Synonymy in No. 1.)

♂ 2133. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 1, 2 and 5.)

Not plentiful, chiefly among rocky hills."—G. C. S.

LEPUS NIGRICOLLIS, Cuv.

The Black-naped Hare.

(Synonymy in No. 5.)

♀ 1823 juv. Kolar, E. Mysore.
juv. 2030, 2031, 2032. Seringapatam, S. Mysore.
♂ 2119. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 5, 6 and 8.)

MANIS CRASSICAUDATA, G. St. Hil.

The Indian Pangolin.

(Synonymy in No. 3.)

♂ 2126. Sivasamudram, S. Mysore.

(*See* also Reports Nos. 3, 6 and 8.)

THE SEROWS, GORALS AND TAKINS OF BRITISH INDIA AND THE STRAITS SETTLEMENTS.

BY

R. I. POCOCK, F.R.S.,

Superintendent of the Zoological Society's Gardens, London.

Pt. II. On the Serows (*Capricornis*) and Gorals (*Nœmorhedus*).

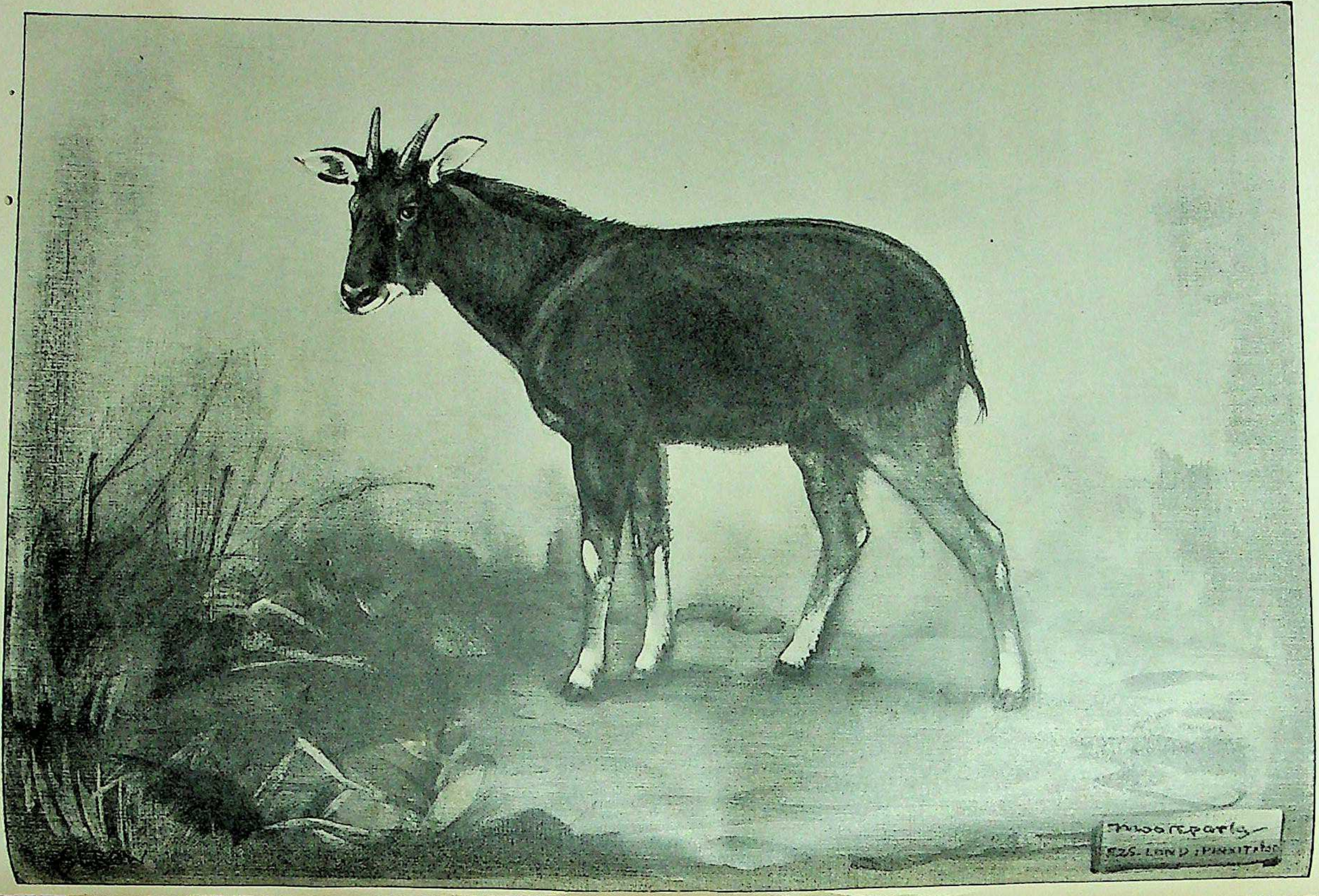
With 3 coloured and 4 uncoloured Plates.

In the February issue of the Journal of this Society for 1910, pp. 807-812, I explained briefly that the Serows, Gorals and Takins, which are confined to Asia, constitute with the Chamois of Europe and the so-called Rocky-Mountain Goat of North America a special but not easily defined group of ruminant ungulates known as the Rupicaprinæ. I also pointed out in greater detail the principal characters, both external and cranial, by which the Gorals, Serows and Takins may be distinguished from each other. It may, however, be useful and save a back reference to my former paper if I recapitulate the chief features by which Gorals (*Nœmorhedus*) and Serows (*Capricornis*) may be separated from one another.

It is a remarkable thing that although Gorals and Serows are very much alike superficially, so much so indeed that they have often been referred to the same genus even by experienced zoologists, they differ nevertheless profoundly in the structure of the skull. The skulls of Gorals approximate those of Takins in several particulars, and suggest a kinship between these two animals which no one would suspect from an examination of living specimens. The skulls of Serows, on the contrary, are very distinct from those of the other genera. Since, however, I am not now concerned with Takins, I will confine my remarks to the main differences between Gorals and Serows. By their cranial characters they may be briefly distinguished as follows:—

(*a*) Maxillæ in contact with the nasals for a long distance in front of the lacrymal bone; lacrymals with a large pit like depression; nasals forming a transverse or slightly arched suture with the frontals; upper rim of orbits not at all prominent.................................... *Capricornis.*

(*b*) Maxillæ separated from nasals by a narrow fissure and only a very short area of the lacrymal touching the nasals;


F.Z.S. LOND : PINXIT

lacrymals without any deep pit; nasals
forming an angular union with the
frontals; upper rim of orbits prominent. *Næmorhedus.*

Although the above mentioned cranial differences are very marked, and do not suggest close relationship between Gorals and Serows, they are nevertheless to a certain extent bridged over in the skull of the small thick coated Japanese Serow formerly called *Capricornis crispus*, but more recently separated as a distinct genus *Capricornulus*. Further evidence that *Capricornulus crispus* is related to the Gorals is furnished by the structure of the foot glands, which resemble those of Gorals, as I have shown in a paper on the cutaneous glands of Ruminants (Proc. Zool. Soc. 1910, pp. 853-855).

Another point of interest about these glands is their close resemblance to those found in the feet of sheep, both wild and domesticated. These glands open by a small orifice in the front of the pastern, above the hoof, and each consists of a short narrow duct and a more voluminous glandular sac which is bent upon itself. For want of material, I have not been able to ascertain whether exactly similar glands are present in Serows or not. To settle this, fresh or unskinned feet are necessary for examination. A living Serow from Darjeeling, now living in the Zoological Gardens, appears to have such glands, judging from the size of their orifices in the forelegs, but I could not find them on the skin of the feet of a specimen of a Chinese species (*Capricornis sumatraensis argyrochætes*), and according to Bosc an example of the typical Sumatran Serow had no foot glands. In the present state of our knowledge, therefore, it is impossible to affirm anything definite about the foot glands of Serows. Serows, nevertheless, have a well developed facial gland opening in front of the eyes by a small orifice, which is not closed by a flap of skin as in sheep and gazelles. In the Serow in the Zoological Gardens, London, referred to above, the secretion of this gland is a clear fluid which soon dries to a substance of the consistency and smell of gum arabic, and the animal itself has a strong smell something like human perspiration, but this, like the smell of goats and sheep, appears to come from the surface of the skin and not from any specially localised glands. It is the presence of this face gland in the Serows that constitutes one of the main external differences between these animals and Gorals, which have no face gland; and this gland in the Serows is lodged in the hollow of the lacrymal bone mentioned above in the brief description of the skull. Apart from this character Serows are much larger than Gorals and have much longer legs. The tail, however, is very much shorter.

The main external differences then between the two animals may be briefly epitomised as follows:—

(*a*) A distinct gland on the face in front of the eye; tail very short; height at withers about three feet............................ *Capricornis.*

(*b*) No gland in front of the eye; tail longish or long; height a little over two feet at the withers .... *Nœmorhedus.*

In the first portion of this paper (Journal Bo. Nat. Hist. Soc. XIX, No. 4, pp. 810-811). I gave briefly the reasons which compel me to adopt the name *Capricornis* for the Serows and *Nœmorhedus* for the Gorals; and it is needless, I think, to repeat them here.

Genus *Capricornis* (Serows).

Nœmorhedus.—H. Smith, Griffith's Animal Kingdom V, p. 352, 1827 (in part).

Capricornis.—Ogilby, P. Z. S., 1836, p. 138 (type *bubalinus-thar*) Gray, List Mamm. Brit. Mus., XXVI. 166, 1843; and subsequent works; Heude, Hist. Nat. Chinois II, pp. 222-234, 1894; Pocock Ann. Mag. Nat. Hist. (8) 1, pp. 183-188, 1908; *id.* Proc. Zool. Soc. 1908, pp. 174-175.

Nemorhœdus.—Blanford, Fauna of British India, Mammalia p. 512, 1891; Lydekker, Great and Small Game of India, p. 128, 1900, and subsequent works.

It would serve no useful purpose in a paper of this kind to follow in detail the progress of our knowledge of the Serows of British India and the Straits Settlements. It will be sufficient to say that until about three or four years ago zoologists, naturalists and sportsmen who wrote about these animals adopted the nomenclature and identifications set forth by Dr. Blanford in his classical work on the Mammalia of the Fauna of British India, pp. 512-515, 1891. This author referred the Serows of these areas to two species, the distinguishing characters of which he epitomised as follows:—

Legs white or grey near the feet................. *bubalinus.*
Legs rufous .... *sumatrensis.*

The range of the first was said to be from Kashmr to the Mishmi Hills; of the second from the Eastern Himalayas, Yunnan and Moupin to Sumatra, through Assam, Burma and the Malay Peninsula.

Without entering upon further criticisms of Dr. Blanford's results, it is necessary to point out here that he deliberately refrained from adopting the oldest available and therefore correct name for the species he named *bubalinus* and that from not consulting the older natural histories he fell into the error of believing that the Sumatran Serow has the legs red below the knees and hocks. If he had known, as he might very easily have known from literature and from a specimen in the British Museum

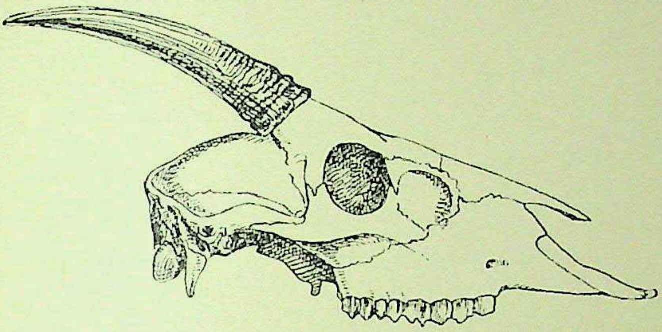


FIG. 1.

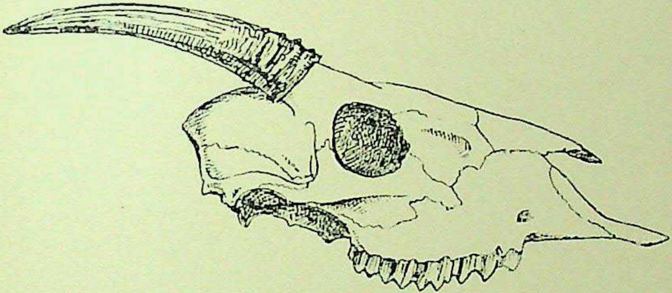


FIG. 2.

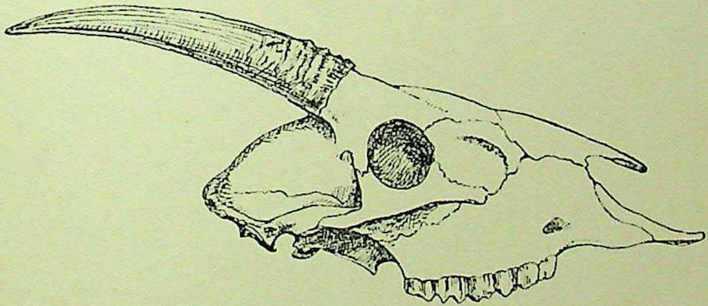


FIG. 3.

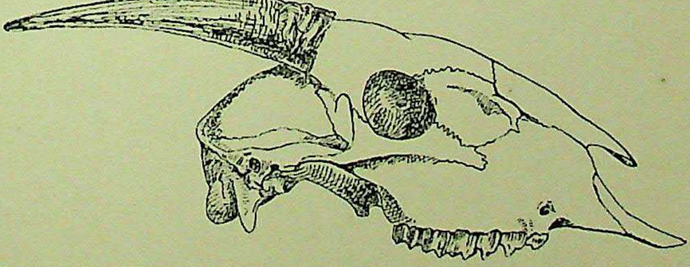


FIG. 4.

SKULLS OF SEROWS.
(Copied with modifications from P.Z.S., 1908.)

FIG. 1.—SKULL OF NEPAL SEROW (*Capricornis sumatraensis thar*).
FIG. 2.—SKULL OF RODON'S SEROW (*Capricornis sumatraensis rodoni*).
FIG. 3.—SKULL OF HUME'S SEROW (*Capricornis sumatraensis humei*) from Pir Panjal.
FIG. 4.—SKULL OF ROBINSON'S SEROW (*Capricornis sumatraensis robinsoni*) from Selangor.

that the limbs of the Sumatran animal are black to the fetlocks, he would have seen that Burmese specimens could not carry the name *sumatrensis* in a restricted sense.

There is no reason to think that Dr. Blanford included more than one race of Serow under the name *bubalinus*. But, setting aside the true *sumatrensis* which he evidently did not know, the synonymy he quoted under that specific named embraced two kinds of Burmese Serows, namely, the red form named *rubidus* by Blyth, and a blackish form with red legs named *milne-edwardsii* by David. If he had known the typical *sumatrensis* and had excluded it as doubtless he would have done, from the British Indian fauna, he would have been compelled to adopt the title *rubidus* for the Burmese Serows. He was quite evidently, however, full of doubt as to the true status of the Serows he discussed, for he wrote: "I am far from satisfied that this goat-antelope (*sumatrensis* so-called) and *bubalinus* are really distinct, or, if they are, whether the Arakan *rubidus* belongs to this form. I follow Blyth in uniting *rubidus* and *sumatrensis*."

The doubts expressed by Blanford on this head were taken up by Mr. Lydekker nine years afterwards [1] and practically expressed by the relegation of the British Indian forms to one species for which the name *sumatrensis* was adopted. A further modification of Blanford's classification was the recognition of *rubidus* as a race, so that three races of *sumatrensis* were admitted in British India, namely, *bubalinus* and *sumatrensis*, *sensu stricto*, and *rubidus*. The only criticism of this classification that need be offered concerns the acceptance and propagation of Blanford's mistake regarding the colours of the legs in the typical *sumatrensis*. This was repeated in the second edition of Great and Small Game of India, etc., issued in 1907.

Dr. Blanford also put Mr. A. L. Butler quite off the scent as to the true affinities of the Serow from the Larut Hills, Perak, which he described as *Nemorhedus swettenhami*, regarding it as a new and quite distinct species mainly on account of its having the legs below the knees and hocks black. If Mr. Butler had known the characters of the Sumatran Serow, he would have seen at once that his Malaccan animal was closely allied to it (Proc. Zool. Soc. 1900, p. 675), the two differing, not in the colour of the legs, but in the colouring of the mane.

The above given summary will show the accepted views of the characters and names of the Serows of British India and the Straits Settlements down to 1907. In that year the necessity for identifying some examples that had been acquired by the Zoological Society of London forced me to take up the question of these interesting animals. Some of the results arrived at were set forth in a paper published by the Society in 1908 (Proc. Zool. Soc. 1908, pp.173—190). The rest are embodied in the following pages.

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[1] Great and Small Game of India, pp. 128—135, 1900.

The first fact that speedily came to light was the characters of the typical Sumatran animal and the discovery that no such race exists, so far as is known, in British India. From the available material, moreover, consisting of skulls and skins mostly preserved in the British Museum, I found reason for thinking that there were no fewer than four races of Serows inhabiting the Himalayas north of Hindostan, namely, one in Kashmir, one in Chamba, one in Nepal and one in Darjiling; that there were two in the Straits Settlements, one coming from Selangor, the other from Perak. To these have now to be added two from different localities in Burma.

Apart from the two from Malacca which are very possibly based on dimorphic phases of one and the same race, the races above mentioned seem to be valid and distinguishable forms in the sense that they appear to be determinable both by cranial and integumental characters. Nevertheless I do not think their distinctive features are sufficiently rigid and invariable to justify us in giving these forms full specific rank, for I have a strong suspicion that when Serows are better known, that is to say, when more material has been collected in the localities whence the types were obtained and in localities from which skins have not yet come to hand, gradations will be traced from one to another and thus justify the view I now hold that all the Serows ranging from Kashmir to Burma belong to one locally variable species.

Although in my previous paper, as in the present one, the known Serows of the Straits Settlements have been also referred to the same species as the Himalayan and Burmese forms, I am not sure that future discoveries will not show that they should rank together with the Sumatran animal, as specifically distinct. This suspicion rests more upon the characters of the skull than upon the colour of the coat, for the skull of the animal from Selangor can be at once singled out from those of the Himalayan animals by its general characters and dimensions, the profile of the nose and forehead being markedly convex, the horns inclining much more strongly backwards, and the cranial region sloping more abruptly backwards and downwards, but in another and younger skull of apparently the same animal, these characters are much less marked. Until, therefore, a good deal more material in the way of properly localised skulls, accompanied by entire skins, has been examined, it seems to me that no final settlement of the exact status to be accorded to the different described forms of Serows can be reached.

Sportsmen who shoot these animals not unnaturally think that there is nothing fresh to be found out about them and are contented with the frontlet or the entire skull and at most the skin on the head. But through the medium of the pages of this Journal I should like to be permitted to appeal for entire skins and skulls accompanied by full particulars as to dates, locality and altitudes. By this means alone can we hope to learn more than we know at present about the variations exhibited by Serows in different localities and the changes, if any, they may show in connection with sex, age and season in the same district. Our existing knowledge on these important points amounts to very little.

The characters of the races of Serows that have been described from different localities within the areas to which this paper is restricted may be briefly tabulated as follows :—

- *a.* Legs below knees and hocks mostly black; horns inclined backwards in the plane of the forehead.
  - *a*¹. Mane composed of black and white hairs.. *robinsoni.*
  - *b*¹. Mane with a considerable amount of red in it .... *swettenhami.*
- *b.* Legs below knees and hocks rusty red or white; horns more uptilted.
  - *a*². Body, head and limbs all red .... *rubidus.*
  - *b*². Body, head and limbs not all red.
    - *a*³. Head and body brownish-black or black.
      - *a*⁴. Legs with a considerable amount of rusty red or yellow below knees and hocks.
        - *a*⁵. Legs below knees and hocks all rusty ; body brownish black...... *milne-edwardsii.*
        - *b*⁵. Legs below knees and hocks rusty fawn ; knees and fetlocks white ; body jet black .... *jamrachi.*
      - *b*⁴. Legs white or dirty white below knees and hocks.
        - *a*⁶. Belly only a little paler than the sides, their colours blending ; much less white on the jaw and throat and breast .... *thar.*
        - *b*⁶. Belly white and sharply contrasted with the rufous-brown of the sides; much white on chest and along lower jaw .... *rodoni.*
    - *b*³ Head pale chocolate-brown, body probably that colour also and legs probably white below .... *humei.*

Capricornis sumatraensis.

Typical sub-species *sumatraensis*, Bechst.

The Cambing Outan, Marsden, Sumatra, ed. 1, p. 93, ed. 3, II, p.115, pl. XIV, 1811.

The Sumatran Antelope Pennant, Quadrupeds, ed. 3, II, p. 321, 1793.

Antilope sumatraensis, Bechstein; Uebersicht-vierfuss. Thiere I, p. 98, 1799 (based on Marsden's Cambing Outan).

Antilope sumatrensis, Shaw, Gen. Zool. II, pt. 2, p. 354, 1801; F. Cuvier, Hist. Nat. Mamm. IV, No. 377, (fig.) 1821; Raffles, Tr. Linn. Soc. XIII, p. 266, 1821.

Nemorhaedus sumatrensis, H. Smith in Griffith's An. Kingdom IV, p. 277, (fig.) 1827; Jardine Nat. Libr. Mamm. IV, p. 97, pl. 2, 1836.

Capricornis sumatraensis, Pocock, Proc. Zool. Soc., 1908, p. 176.

Prevailing colour black, with a thick grey mane on the neck and withers. Areas of the legs below the knees and hocks black turning brown only on the fetlocks.

Distribution.—Sumatra.

Although this race of Serows occurs geographically outside the localities indicated by the title of this paper, I have thought it wise to include a brief description of it, with full synonomy, on account of the erroneous conception of its characters conveyed by most of the literature dealing with Indian and Burmese Serows.

There is very little material available for description; but judging from the skin of a young specimen ticketed Sumatra in the British Museum (*Raffles*), the animal has a considerable quantity of brown on the face between the eyes and nose; but the forehead and cheeks are black. The upper lip is whitish, there is a whitish area extending from the lower lip along the edge of the jaw on each side and a dirty grey patch on the throat. Ears brown at the back, noticeably paler than the black of the neck. The occipital crest is almost all black, but the mane becomes progressively greyer posteriorly and forms a large greyish crest on the withers. The general colour of the body is black intermixed with brown and there is no white or dirty white in the chest, belly or inside of the legs. The legs are blackish brown, the fetlocks being rather browner than the upper parts, but there is no abrupt change of colours at the knees and hocks.

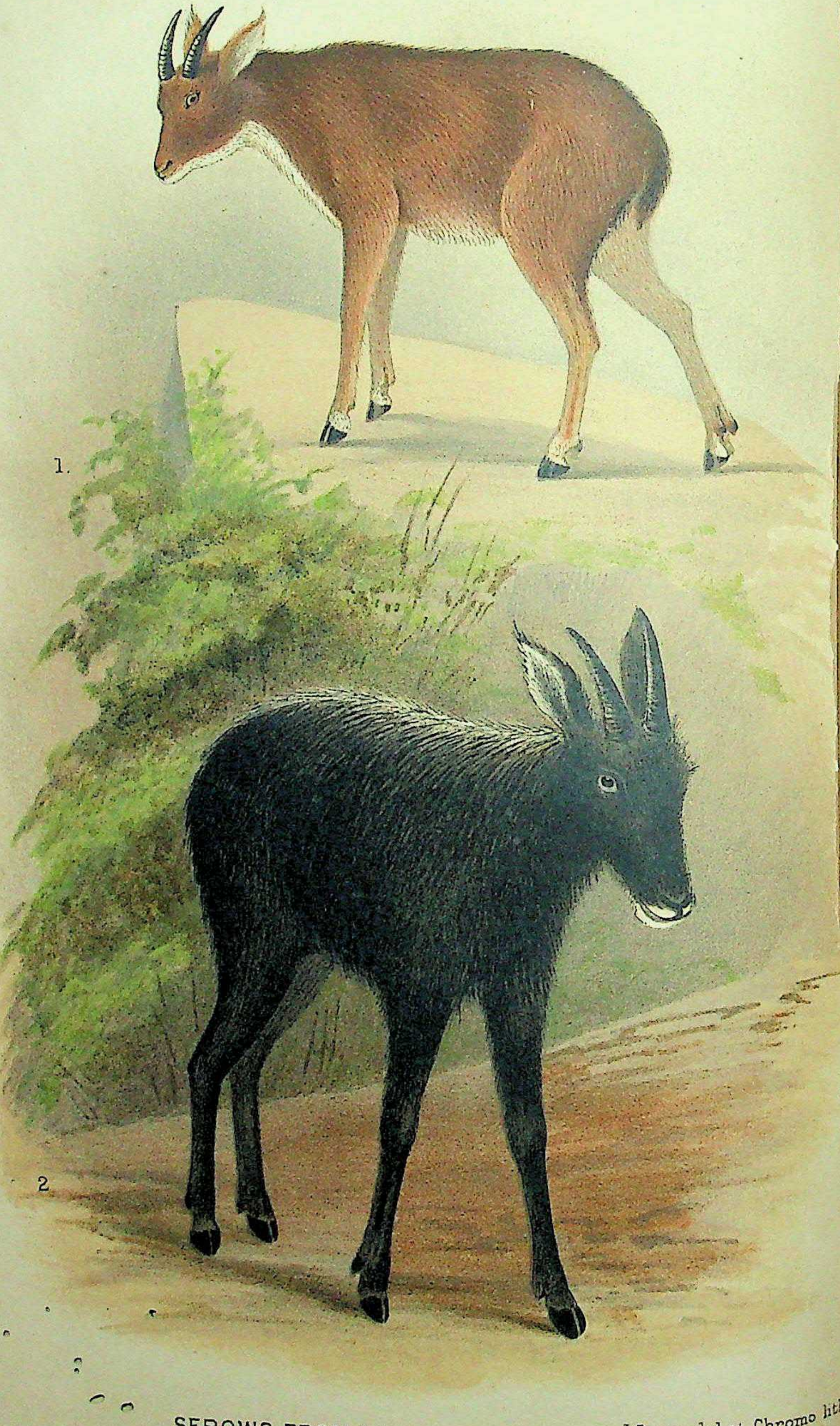
Subspecies *robinsoni*, Pocock.

Capricornis sumatraensis robinsoni, Pocock, Proc. Zool. Soc., 1908, p. 185, text fig. 35, (living animal), 36 (skull).

Closely related to the typical Sumatran race, but differing apparently in that the mane is crest-like instead of mat-like and composed of a mixture of black and white hairs.

Distribution.—Selangor and ? Perak in the Malay Peninsula.

This race of Serows was based upon the skin and skull of an example presented to the Zoological Society by the Government



SEROWS FROM BURMA AND MALACCA.

J. Green del. et Chromo lith.

1. Capricornis sumatraensis rubidus. 2. Capricornis sumatraensis robinsoni.

of Selangor. The animal was actually captured near Batu on the Coast of Selangor; but according to Mr. H. C. Robinson, it must have wandered thither either from the range of hills between Selangor and Negri Sembilan to the south of it, or possibly from the main range of the Malay Peninsula.

In 1908 a second specimen was forwarded to the Society by Mr. Robinson's Assistant, Mr. Boden Kloss. This resembled in colour the first example from Selangor. It was said, nevertheless, to have been captured in Perak. It was to this specimen that belonged the skull, mentioned above, as differing in certain particulars from the skull of the type of *robinsoni*.

Subspecies: *swettenhami*, Butler.

? *Nemorhædus sumatrensis*, Cantor, Journ. As. Soc., Bengal XV., pp. 272-278, 1846.

Nemorhædus swettenhami, Butler, Proc. Zool. Soc. 1900, p. 675.

Nemorhædus sumatrensis swettenhami, Lydekker. The Game Animals of India, Burma, Malay and Tibet, 1907, p. 147.

Capricornis sumatraensis swettenhami, Pocock. Proc. Zool. Soc. 1908, pp. 186-187.

General colour black. The back strongly, the sides slightly grizzled with grey, the bases of the hairs being white. Mane black, mixed with whitish hairs on the forepart of the neck and with reddish hairs towards the withers. Inside of thighs rusty red. Neck, chest, belly, legs and tail black. Head black, but the lips whitish grey, with some red on the upper lip, posteriorly a patch of red on the lower jaw beneath. A rusty red patch on the throat. Skull unknown. Horns from 6 to 8½ inches long.

Distribution.—The Larut Hills in Perak; Biserat in the Malay Peninsula.

There are two specimens of this animal in the Perak Museum, an adult and young, which, according to Mr. Butler, are alike in colouration, except that the kid had a narrow rufous band above the hoof. A third specimen also resembling them, has been seen by that gentleman; and there is a skin from Biserat in the British Museum which seems to be of exactly the same type.

The evidence supplied by these skins of the apparent constancy of the colouration of the Larut examples justified the view that the Selangor example above described as *robinsoni* represented a distinct race intermediate between *swettenhami* and typical *sumatraensis*. But this evidence was weakened by the arrival of the *robinsoni* form from Perak. I have, moreover, seen a skin in the British Museum from the Siamese frontier of Malacca which seems to me to be indistinguishable from typical *sumatraensis*. From these facts I now incline very strongly to the opinion that the Serows from South Malacca, named *swettenhami* and *robinsoni* are probably racially identical with typical *sumatraensis* as Hamilton Smith long ago thought. It would, however, be premature, I think, to unite them before craniological proof of their identity is forthcoming. Whether the Serows from Tenasserim mentioned by Dr. Cantor belong to this black-legged race or to *rubidus* or *milne-edwardsii* or are different from all three, remains to be ascertained.

Subspecies : *rubidus*, Blyth.

Capricornis rubida, Blyth, Cat. Mamm. Asiatic Soc., p. 174, 1863 (foot-note).

Capricornis sumatrensis, Blyth, Cat. Mamm. Burma, p. 46, 1875.

Nemorhædus sumatrensis, Blanford, Fauna of British India : Mammalia, pp. 514-515, 1891 (in part).

Nemorhædus rubidus, A. L. Butler, Proc. Zool. Soc., 1900, p. 675.

Nemorhædus sumatrensis rubidus, Lydekker, Game Animals of India, p. 143, 1907.

Prevailing colour red all over, paler beneath, a blackish spinal stripe extending to the tip of the tail ; white on the chin, lower jaw and upper end of the throat ; whitish on the fetlocks and sometimes also on the knees.

Distribution.—Assam (Shillong), Chittagong, Arakan, Salween.

I am indebted to Dr. N. Annandale, the Director of the Indian Museum, Calcutta, for the following information about the type and other examples of this race of Serows preserved in the Museum under his charge. "The type of *C. rubida* appears to have been destroyed, judging from an old annotated copy of the Asiatic Society's Catalogue, over 30 years ago, before the Society's collection was transferred to the Indian Museum." There are two other examples, however, in the collection, one from Shillong, the other, a young one, from Chittagong. Dr. Annandale's temporary Assistant Mr. T. Bentham, kindly supplied the following particulars about these in answer to some inquiries I made with regard to points Blyth had omitted to mention. "The individual hairs are white at the base and red distally and have no black in them ; the knees and fetlocks are white and the white of the chin extends along the lower jaw to join the white patch on the throat. The underside is not white but dirty greyish fawn which extends only on the extreme underside of the body and reaches the knee joints on the inside of the legs ; the whorls of hair at the base of the forelegs in front, are not white but light golden brown with white bases to the hair." Blyth's original specimens, namely, a mounted head and two flat skins, it may be added, came from Arakan.

Of this race I have only seen two skins. One is in the British Museum but unfortunately has no locality. It is that of an adult animal and belonged to Hume's collection. The other skin is that of a young animal from Arakan, shot by the late Mr. C. E. Mumford. For the opportunity to examine this I am indebted to Mrs. Mumford. These differ in some interesting particulars from each other and also to a certain extent from the Shillong and Chittagong specimens in the Calcutta Museum.

In Mr. Hume's specimen the upper lip, rim of the muzzle, chin, interramal area of jaws and the throat patch are white. The head, neck and body are covered with fiery-red hairs, the head and neck being much redder than the body, the grey basal portion of the hairs of the body showing to a great extent and imparting a hoary aspect to this region. The hind quarters are darker than the body. There is a distinct but narrow black spinal stripe and the tail has a black tip. The hairs of the mane are red distally, black basally. The legs are reddish brown throughout, showing no decided change of colour at the knees and hocks, but are patched with white on the fetlocks. The lower surface of the body and the insides of the limbs at the base are greyish-red, not white.

The skin of the young specimen shot by Mr. E. G. Mumford on Kyauk-pin-daung mountain in the hill tracts of northern Arakan resembles the last described specimen in a general way. The sides of the neck are a uniform rusty yellow, the hairs being white basally but having no black in them. The shoulders and the rest of the body are darker owing to a noticeable quantity of black in the middle of each hair, the base being white and the distal end red. The hairs of the mane show the same three colours, but along the spine the encroachment of the black over the red in the hairs forms the dark spinal stripe. The upper portions of the limbs are rather darker than the body (the lower portions, like the head, have been cut away), but at the base of the forelegs on the inner side, the whorl of hairs, present in all Serows and Gorals, is quite white, and this colour extends for a short distance up the throat in front and backwards on to the inner side of the legs. There is also a white patch on the inner side of the thigh in front.

In the presence of the white upon the chest this specimen differs markedly from Mr. Hume's specimen and also from the two in the Calcutta Museum. It is also considerably darker than the former owing to a greater amount of black in the hairs of the body. The Calcutta specimens from Shillong and Chittagong it may be noted again, have no black in the hairs. Finally in Hume's specimen the hairs of the mane are black at the base and red distally, whereas in Mr. Mumford's example the extreme bases of the hairs of the mane are white. I suspect, however, that these differences in Mr. Mumford's specimen are attributable to immaturity.

It may be added that the presence of black in the hairs of some of the red Serows serves to connect these animals with Serows of the ordinary type in which the black prevails.

In response to my inquiry concerning the habitat of these goat-antelopes, Mrs. Mumford kindly furnished me with some particular which I venture to quote verbatim from her letter:—

"Both species of goat (Red Serow and Grey Goral) were shot during Xmas-week, 1900, upon a mountain in the Arakan hill tracts called Kyauk-pin-daung. The mountain is of very curious formation for it rises abruptly out of the hills to a great height, being in the form of a horse-shoe. It is sheer both on the convex and concave sides of the horse-shoe. The top is a tableland at its widest (say) a mile across, sloping up gradually to the highest point and overgrown with a fine variety of coarse garss which sparsely covers the slabs of rock and boulder of which the mountain is formed. The convex side of the mountain presents a stern and weather-worn aspect; and there is only scrub vegetation consisting of bushes and coarse grass with some few deciduous trees on its face. Here the goats live. On the concave side there is little or no bamboo on the rock, but all up its face there are plenty of small deciduous trees. The undergrowth here is so thick that it is impossible to see anything except at close quarters, whereas the convex side of the mountain is comparatively bare. The sloping surface of the mountain leading on each side from its extremity up to the shoulder where the tableland begins is covered like all the hill tracts, with a maze and jungle of fine bamboo, which, however, ends abruptly at the edge of the tableland, which in addition to the coarse grass already mentioned bears the common English bracken. Both bison, tzaing (the Burmese wild cattle) the black Honey Bear and a species of deer range this tableland, also tiger and elephant; but they do not live there as it is only after the rains that the grass springs up and attracts the elephant, bison and tzaing up to feed. There are no monkeys so high up, though from the highest point late at night or early in the morning their chattering may be heard hundreds of feet below.

I well remember the day the red goat (Serow) was shot. My husband and a friend and I were out after brown goats (Goral) and while peering with glasses over the precipice we saw far below a large reddish goat lying up. She was lying sunning herself under a bare tree, the trees being leafless at that time of the year, and did not seem to hear us. I fired at her, but whether I hit her or not we never knew, for she jumped up and plunged away; but my husband fired immediately after I did and one of us must have hit her young one which was lying between her and the tree and which we had not seen. Hearing it cry she came back again, calling to it, but a third shot frightened her, and she plunged down the cliff helter skelter followed by a shower of stones and shale.

The little one was recovered by the coolies who went after it by being let down the face of the cliffs by ropes. These red goats were very shy indeed. It was difficult to get within shot at all and though we were on the ground some days we never saw them in groups but singly or a female with her young one almost invariably."

For the record of the red Serow from Salween we are indebted to Mr. G. W. Bird, who says it is common in the limestone hills of the Salween Valley (*Field*, Jan. 9th, 1909, p. 62).

Sub-species : *milne-edwardsii*, David.

Capricornis milne-edwardsii, David, Nouv. Arch. Mus. V, p. 10, 1869.

Antilope (*Nemorhædus*) *edwardsii*, M. Edwards, Rech. Mamm., p. 364, pls. LXXII-LXXIII.

Nemorhædus edwardsii, Anderson, An. Zool. Res., p. 335.

Nemorhædus sumatrensis, Blanford, Fauna of British India: Mammalia, pp. 514-515, 1891 (in part).

Colour brownish-black or blackish with some reddish hairs intermixed on the outer side of the thighs, the legs below the knees and hocks rusty-red throughout both externally and internally.

Distribution.—Moupin in Eastern Tibet; Yunnan; Burma, Moulmein and Pegu.

Evidence for, but not proof of, the existence of this race in British Burma is supplied by Beavan who described a specimen from Zwagaben, a limestone hill near Moulmein, and declared he had seen Serows like it at Thayet-mayo in Pegu. The prevailing colour was black with a tinge of hoary, the belly and tibiæ [*sic*] being rufous; the throat was rufous and white tipped, the buttocks rufous and white; the inside of the ears white with black tips and edges. It may be inferred that by "tibiæ" the writer meant the area of the legs below the knees and hocks, and presumably the expression "white-tipped" as applied to the throat referred to the ends of the hairs. The upper lip, lower lip and chin, a narrow band behind the muzzle and the whole of the inferior edge of the lower jaw as far back as the throat whitish.

The description of these animals (Proc. Zool. Soc. 1866, p. 4) is not sufficiently detailed to make their identification absolutely certain; but so far as it is possible to judge, they seem to resemble the Moupin and Yunnan form more nearly than any other. At all events the evidence that a blackish Serow with red legs inhabits the southern portions of British Burma is complete and its coloration serves to affiliate it with the Moupin race rather than with those inhabiting the Straits Settlements and Sumatra.

A closely allied form apparently resembling typical *milne-*

edwardsii in colour except that the fronts of the cannon bones appear to be black has been recorded by Mr. H. Shaw Dunn from Kyonklongyi and other localities in the North Shan States of Upper Burma where it lives mostly in evergreen forests at altitudes of from 4,500 to 6,000 feet. (*Field*, Jan. 9th, 1909.)

Sub-species: *jamrachi*, Pocock.

Capricornis sumatraensis jamrachi, Pocock, Proc. Zool. Soc. 1908, p. 183, text fig. 34 (living animal).

Prevailing colour coal black with the hairs basally white, upper lip, chin and a stripe from the latter running backwards along the lower jaw beneath white. Underside of body dirty greyish-brown. Hairs of the foreleg above the knee and of the outer side of the thigh down to the hock mixed with brown and black; area of legs below knees and hocks rufous yellow externally, with the fetlocks and knees white and the inner side whitish. The coat is shortish at all seasons of the year and has little or no underfur.

Distribution.—Kalimpong near Darjiling.

Two specimens of this sub-species, both imported by Mr. Jamrach from the above mentioned locality, have been seen by me. One is a mounted example in the British Museum, the other is living in the Zoological Society's Gardens. Col. Kinloch, however, shot a Serow near Darjiling, which according to Blanford was intermediate between the species Blanford named *bubalinus* and *sumatraensis*. Since these two are the same as those here named *thar* and *milne-edwardsii*, between which *jamrachi* occupies a middle place, it is practically certain that Kinloch's specimen belonged to the race now under discussion.

The skull characters of this race are unknown.

A special point of interest connected with this Serow is that an example purchased when about six months old by the Zoological Society of London in August 1906 has not changed appreciably in colour or other characters down to the present time (Dec. 1912), when she is nearly seven years old. From this it may be inferred that there is to all intents and purposes no seasonal colour change in this race and that the young is like the adult.

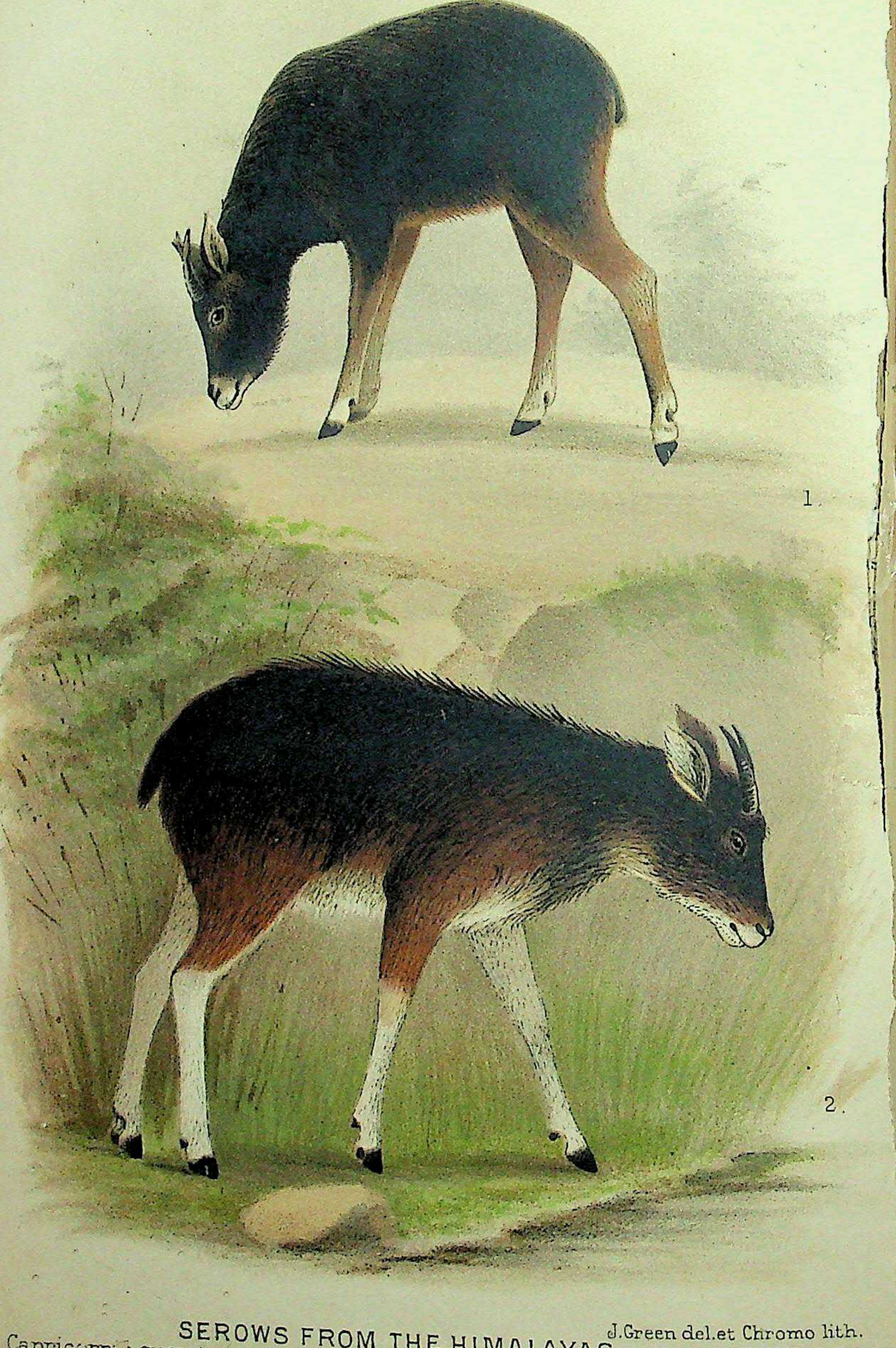
Sub-species: *thar*, Hodgson.

The Bubaline Antelope, Hodgson, Gleanings in Science III, p. 122, 1831.

Antilope thar, Hodgson, Gleanings, etc., III, p. 324, Oct. 1831, *id.* Proc. Zool. Soc. 1833, p. 105.

Antilope bubalina, Hodgson, Proc. Zool. Soc., 1832, p. 12.

Antilope (Nemorhædus) thar, Hodgson, Proc. Zool. Soc., 1834, p. 86.



J. Green del. et Chromo lith.

SEROWS FROM THE HIMALAYAS.

1. Capricornis sumatraensis jamrachi. 2. Capricornis sumatraensis rodoni.

Capricornis thar, Ogilby, Proc. Zool. Soc., 1836, p. 138.

Nemorhædus proclivus and thar, Hodgson, Journ. As. Soc. Bengal, X, p. 913, 1841.

Nemorhædus or *Capricornis bubalinus*, Adams, Blyth, Jerdon, Blanford and others.

Nemorhædus bubalinus typicus and *N. sumatraensis bubalinus*, Lydekker.

Capricornis sumatraensis thar, Pocock, Proc. Zool. Soc., 1908, p. 176, fig. 30, id. Journ. Bombay Nat. Hist. Soc., XIX, No 4, p. 823, 1910.

Closely allied to the last described race, but with the legs whitish or greyish-white below the knees and hocks and without the very decided rusty fawn tint on the outer side of the cannon bones. The lower surface is at most dirty greyish-brown and not clear white as in the Chamba race which follows.

Distribution.—Nepal, Sikhim, Chumbi.

There are a few old and mounted skins of this animal in the British Museum procured by Hodgson in Nepal and one from Sikhim presented by Blanford. Capt. Bailey recently shot a specimen in Chumbi, as recorded in this Journal Vol. XIX, p. 823, 1910.

Skulls of this Serow sent by Hodgson from Nepal are less convex in the frontal and nasal region than are the skulls of the two Himalayan races described below.

The synonymy of this animal has been quoted somewhat fully to show that *thar* and not *bubalinus* is the earliest name given to it, and therefore the one that must be adopted irrespective of frequency of use and the quite unimportant predilections of individual authors.

Sub-species : *rodoni*, Pocock.

Capricornis sumatraensis rodoni, Pocock, Proc. Zool. Soc., 1908, p. 180, text figs. 32 (skin) and 33 (skull).

General colour brownish-black, the black portion of the hairs tinged with red. Upper lip, lower lip and chin white, the white from the chin running along the lower jaw and joining a conspicuous patch at the upper end of throat. Sides of body, shoulders and thighs browner than the back. Chest, belly, inside of thighs and of upper portion of forelegs and the whole of the outer side of the legs from above the knees and hocks white, the white of the belly and chest sharply defined from the brown of the flanks and neck.

Distribution.—Chamba in the Punjab.

This race of Serows is at present known from a skin and skull sent to me by the late Major G. S. Roden, F. Z. S. It may be distinguished from the Nepalese race (*thar*) by the characters set forth in the table (p. 303). In addition to the characters there enumerated, it may be added that the coat is long and shaggy, and has a plentiful supply of underfur, whereas in *C. s. thar* the coat is more scanty and has little or no underfur so far as is known. This indicates that the Chumba Serows live at a higher altitude than those of Nepal. There are also differences of the skull, the nasal bones of *C. s. rodoni* being extremely short, much shorter in fact than in *C. s. thar* and the following race *C. s. humei*.

Sub-species: *humei*, Pocock.

Capricornis sumatraensis humei, Pocock, Proc. Zool. Soc., 1908, p. 178, text fig. 31 (skull.)

Distinguishable from the previously described races of Serows by the uniform pale chocolate brown colour of the head.

Distribution.—Kashmir.

This race is represented in the British Museum by a mounted head belonging to Mr. Hume's collection. Apart from this nothing is known of the pelage, but since the head is approximately the same colour as the neck and body in all Serows hitherto described it may be inferred that this Kashmir race is pale brown all over. Moreover, if the law of the progressive change in the colour of the legs from nearly black in specimens from Southern Malacca to white in examples from Chamba holds good to the west of the last named district, the Kashmir animal will also prove to have white legs. To sportsmen in Kashmir we must look for the settlement of these questions. If it may be urged as a criticism of basing a race of Serows on a single mounted head that the hairs may have faded from black or dark brown to pale brown, it must be replied that one of Hodgson's Nepalese specimens has been exhibited for at least the same length of time without turning to the pale shade seen in Hume's example.

Further evidence for the distinctness of Kashmir Serows from those further east is also supplied by a skull in the British Museum from Pir Punjal, formerly belonging to Mr. Lydekker. It is, of course, not certainly known that this skull resembles that of Hume's specimen, but until there is evidence to the contrary, this may be assumed to be the case. This skull differs from that of the Chamba race (*rodoni*) in having much longer nasal bones and much shorter frontal bones, the suture between the two being near the middle of the upper edge of the lacrymal bone. The length of the nasal bones far exceeds the length of the frontals measured from the naso-frontal suture to the posterior rim of the orbit. In the skull of the type of *rodoni* the nasal bones when so measured fall short of the posterior rim of the orbit.

Genus: NEMORHÆDUS (Gorals).

Nemorhædus, H. Smith, Griffith's Animal Kingdom, V, p. 352, 1827, (in part); Gray, List Mamm., Brit. Mus., p. XXVI, 1843, *id.* Ann. Mag. Nat., Hist. XIII, p. 232, 1846, and later works (type, *goral*); Pocock, Ann. Mag. Nat. Hist. (8) I, pp. 183-188, 1908; *id.* Proc. Zool. Soc., 1908, p. 190.

Kemas, Ogilby, Proc. Zool. Soc., 1836, p. 138 (type, *goral*); Blanford, Mamm. Brit. India, pp. 513-516, 1891 (nec *Cemas*, Oken, Lehrb. Zool. II, p. 727, 1816).

Caprina, Radde, Reisen in Süd. Ost. Sibirien I, pp. 262-270, 1862-1863 (type, *raddeanus*).

Urotragus, Gray, Ann. Mag. Nat. Hist. (4) VIII, p. 371, 1871.

Errata.

Line 2 after "table," *read* (p. 301).

with a 'C' instead of a 'K,' in a totally different sense, that is to say, for a number of Antelopes in which the Goral was not included. *Kemas* was, however, resuscitated for the Gorals and *Nemorhædus* transferred to the Serows by Blanford, who either did not know of Gray's settlement of the question or thought he could set it on one side. Then came Mr. Lydekker who, seeing quite rightly the inadmissibility of *Kemas* and not being aware presumably of what Gray had done, followed Blanford in using *Nemorhædus* for the Serows and introduced for the Gorals the name *Urotragus* which had been given by Gray in 1871 to a long-tailed species inhabiting north China, namely, *caudatus* of Milne-Edwards. But Radde in 1863 had cited another north Chinese species as *Antilope* (*Caprina*) *crispa* [1]; so that even if Blanford and Lydekker were right in calling the Serows *Nemorhædus* the claims of *Caprina* would have to be considered before *Urotragus* was adopted for the Gorals. But as I have said, Gray had straightened the distinguished from the Nepalese race (*thar*) by the characters set forth in the table (p. 303). In addition to the characters there enumerated, it may be added that the coat is long and shaggy, and has a plentiful supply of underfur, whereas in *C. s. thar* the coat is more scanty and has little or no underfur so far as is known. This indicates that the Chumba Serows live at a higher altitude than those of Nepal. There are also differences of the skull, the nasal bones of *C. s. rodoni* being extremely short, much shorter in fact than in *C. s. thar* and the following race *C. s. humei*.

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[1] This species being wrongly identified as *crispa* of Temminck, was correctly renamed *raddeanus* by Heude.

Sub-species: *humei*, Pocock.

Errata.

Line 16, *read* (cf. p. 296).

of basing a race of Serows on a single mounted head that the hairs may have faded from black or dark brown to pale brown, it must be replied that one of Hodgson's Nepalese specimens has been exhibited for at least the same length of time without turning to the pale shade seen in Hume's example.

Further evidence for the distinctness of Kashmir Serows from those further east is also supplied by a skull in the British Museum from Pir Punjal, formerly belonging to Mr. Lydekker. It is, of course, not certainly known that this skull resembles that of Hume's specimen, but until there is evidence to the contrary, this may be assumed to be the case. This skull differs from that of the Chamba race (*rodoni*) in having much longer nasal bones and much shorter frontal bones, the suture between the two being near the middle of the upper edge of the lacrymal bone. The length of the nasal bones far exceeds the length of the frontals measured from the naso-frontal suture to the posterior rim of the orbit. In the skull of the type of *rodoni* the nasal bones when so measured fall short of the posterior rim of the orbit.

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Kemas, Ogilby, Proc. Zool. Soc., 1836, p. 138 (type, *goral*); Blanford, Mamm. Brit. India, pp. 513-516, 1891 (nec *Cemas*, Oken, Lehrb. Zool. II, p. 727, 1816).

Caprina, Radde, Reisen in Süd. Ost. Sibirien I, pp. 262-270, 1862-1863 (type, *raddeanus*).

Urotragus, Grey Ann. Mag. Nat. Hist. (4) VIII, p. 371, 1871, (type, *caudatus*); Lydekker, Zoologist, 1905, p. 83; *id.* Great and Small Game of India, 1900, p. 136 and subsequent works.

The essential characters of this genus are enumerated above (cf.p. 300).

Distribution.—Himalayas from Kashmir to Sikhim and Bhotan Assam, Arakan in Burma, and northwards through China to Corea.

The synonymy of this Genus which was long ago settled by Gray has been quite needlessly confused by authors who followed him. Hamilton Smith included both Gorals and Serows under *Nemorhædus* and this name must stand either for the one genus or the other. Neglecting this law Ogilby ignored *Nemorhædus* and called the Serows *Capricornis* and the Gorals *Kemas*. Gray, who followed him, put the matter right by reserving *Capricornis* for the Serows and keeping *Nemorhædus* for the Gorals. He dropped *Kemas*, very wisely, because Oken had previously employed the name, spelt with a ' C ' instead of a ' K, ' in a totally different sense, that is to say, for a number of Antelopes in which the Goral was not included. *Kemas* was, however, resuscitated for the Gorals and *Nemorhædus* transferred to the Serows by Blanford, who either did not know of Gray's settlement of the question or thought he could set it on one side. Then came Mr. Lydekker who, seeing quite rightly the inadmissibility of *Kemas* and not being aware presumably of what Gray had done, followed Blanford in using *Nemorhædus* for the Serows and introduced for the Gorals the name *Urotragus* which had been given by Gray in 1871 to a long-tailed species inhabiting north China, namely, *caudatus* of Milne-Edwards. But Radde in 1863 had cited another north Chinese species as *Antilope* (*Caprina*) *crispa* [1]; so that even if Blanford and Lydekker were right in calling the Serows *Nemorhædus* the claims of *Caprina* would have to be considered before *Urotragus* was adopted for the Gorals. But as I have said, Gray had straightened the matter strictly in accordance with the rules of nomenclature long before all these difficulties, initiated by Blanford, arose and I can see no excusable pretext for ignoring his decision unless each author has the right to choose the name he pleases for an animal irrespective of the work of his predecessors.

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[1] This species being wrongly identified as *crispa* of Temminck, was correctly renamed *raddeanus* by Heude.

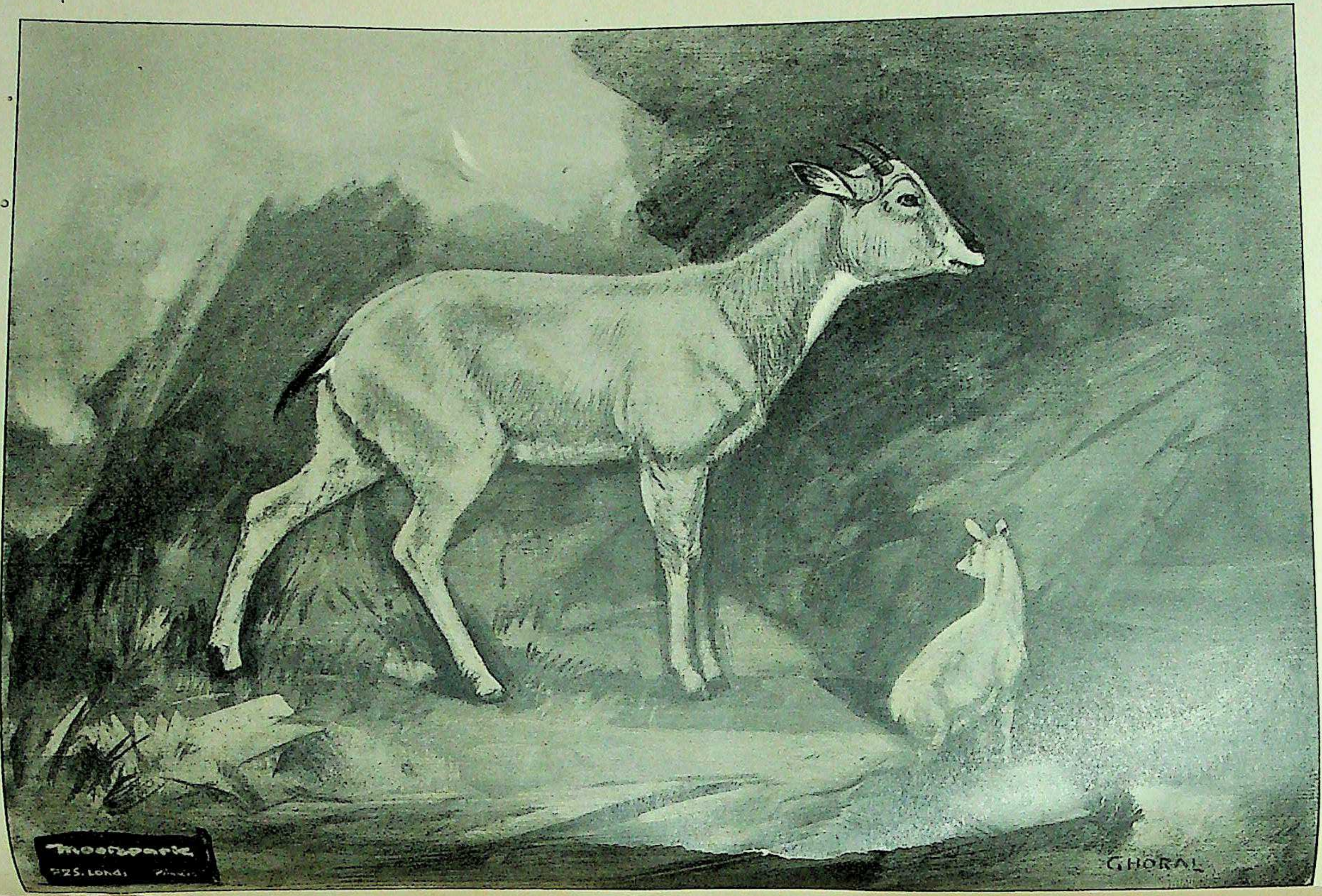
The three species of Gorals now recognised from British India and Burma may be distinguished as follows :—

a Tail shorter, about three inches long exclusive of the hair : black stripe on foreleg passing over the knee down the middle of the cannon bone to the fetlock (Himalayas).
  b Grey or fawn-grey, more or less suffused with black ; spinal stripe absent or not passing beyond withers ; no stripe down middle of tail and none up back of thigh ... *goral.*
  *b*¹ Brown suffused with black ; spinal stripe reaching at least to croup ; a black stripe down tail ; blackish up back of thigh ... *hodgsoni.*
*a*¹ Tail longer, about 5 inches without hair ; black stripe on foreleg not passing over knee but turning and running down outer side of cannon bone (China to Arakan) ... ... *griseus.*

The Himalayan Gorals.

In Blanford's Mammals of British India, pp. 516-517, the Gorals of the Himalayas were assigned to a single species to which the name *Cemas goral* was given. But in 1905 Mr. Lydekker pointed out that there are two types of this animal in that mountain range, namely, a ' grey ' type and a ' brown ' type. To the grey one he gave the new name *bedfordi* and restricted the old name *goral* to the ' brown ' one. That these two kinds of Goral exist is undeniable, but Mr. Lydekker's selection of the technical names was most unfortunate, because Hardwicke, the original describer of *Antilope goral*, expressly stated that the animal to which he gave the name, a specimen living in the Barrackpore menagerie whither it had been sent from Katmandu, was of a ' grey mouse-colour,'' the Latin diagnosis running ' *corpore supra colore murino canescente*'. Since it is quite impossible to believe that Hardwicke could have applied those epithets to an animal which was independently described by Hodgson as ' rusty and brown ', by Blanford as ' brown, more or less rufous ' and by Mr. Lydekker as ' rufous brown', there is no logical escape from the conclusion that Mr. Lydekker's ' grey ' goral is the same as Hardwicke's goral and must take the technical term *goral*, with *bedfordi* as its synonym.

Clearly, therefore, it was the ' brown ' Himalayan Goral that required a new name and not the ' grey ' one. This name I


GHORAL
F.Z.S. Lond.

supplied in 1908, when I dedicated the species to Brian Hodgson who was the first to discover and misname it.

The available evidence shows that the grey goral which ranges at least from Chamba to Nepal, is a more westerly form than the 'brown' one which extends from Nepal to Sikhim. They may prove to be merely local races of one species; but since we have no actual proof that they intergrade even in Nepal where both types occur, it is better perhaps to regard them as distinct species. At the same time it cannot be claimed that the differences between them have the same value as the differences which distinguished the Burmese Goral from both of them.

Næmorhedus goral, Hardwicke.

Antilope goral, Hardwicke, Tr. Linn. Soc. Zool. XIV, p. 518., pl. XIV, 1825; H. Smith, Griffith's An. Kingdom IV, p. 279, 1827; Jardine, Nat. Library, Mammalia IV, p. 98, 1836.

Urotragus bedfordi, Lydekker, Zoologist 1905, p. 83, *id.* Game Animals of India p. 151, 1907, *id.* in Rowland Ward's Records of Big Game p. 343, fig. 1907.

Næmorhedus goral, Pocock, Proc. Zool. Soc. 1908, p. 192, fig. 37.

Nec *Nemorhædus goral*, Hodgson; *Cemas goral*, Blanford; *Urotragus goral*, Lydekker.

Colour yellowish-grey suffused with black, varying considerably in tint individually but the pale area of the hairs never rufous or brown; forehead and sides of nose suffused with rusty yellow; chin, upper lip, underside of jaws and throat patch white, the latter sometimes yellowish and dark edged. Occasionally a darker spinal stripe on the nape and withers, but usually none, although this area often appears darker owing to the dark basal portion of the hairs showing when they are erect. Tip of tail black. No blackish stripe running up back of thigh from the hock to the root of the tail. Legs below knees and hocks varying from grey to rich fawn; the foreleg usually but not always black down the middle over and below the knee, the hindleg usually darker, often blackish, behind from the hock to the fetlock. Ventral surface and inside of thighs whitish.

Distribution.—Chamba, Dharmsala; Nepal, ? Kashmir.

On general grounds it seems probable that Kashmir Gorals are specifically the same as those that occur at Chamba; but I am not acquainted with any description of Gorals from Kashmir, nor have I seen any skins. Of Gorals from Chamba, I have examined eight examples shot by H. H. the Rajah and kindly sent to me through the late Major Rodon. The type of *N. bedfordi*, an example that lived at Woburn, came probably, as I learnt from Mr. Jamrach, the importer, from Dharmsala. Evidence for the extension of this grey goral into Nepal is furnished by a skin shot by Maharajah Dhuleep Singh and now preserved in the British Museum. This skin has an important bearing on Hardwicke's statement that the grey goral he described as *Antilope goral* came from Nepal.

I may add that Major Rodon was strongly of opinion that both the 'grey' and 'brown' Gorals occur at Chamba and to convince me of this he forwarded to me the series of specimens above mentioned, which were shot by the Rajah. Clearly, however, these all belong to the 'grey' type.

A living male example of this species was presented as a young animal to the London Zoological Society in 1904 by Major G. S. Rodon and is still living. It is important to record that this specimen has not changed appreciably in colour during its eight years' sojourn is England. It has shown no tendency whatever to assume the brown coloration of the species next described.

Næmorhedus hodgsoni, Pocock.

Nemorhædus (*Antilope*) *goral*, Hodgson, Proc. Zool. Soc. 1834, p. 85.

Cemas goral, Blanford, Fauna of British India; Mammalia p. 516, 1891 (in part).

Urotragus goral, Lydekker, Zoologist, 1905, p. 83; *id.* Game Animals of India, etc., 1967 p. 151.

Nemorhædus hodgsoni, Pocock, Proc. Zool. Soc. 1908, p. 195. Nec. *Antilope goral*, Hardwicke, H. Smith, Jardine, Pocock.

Colour varying in tint but always golden or rufous brown speckled with black; forehead and nose darker, cheeks paler; chin, lower side of jaws and throat patch generally yellower than in *N. goral*. A black spinal stripe extending from the head to the root of the tail but tapering away and almost evanescent on the croup. Tail black above. A dark, often ill defined stripe running up the back of the thigh from the hock. Legs below knees and hocks golden brown, generally with a median black stripe. Belly and inside of thigh greyish yellow.

Distribution.—Nepal and Sikhim.

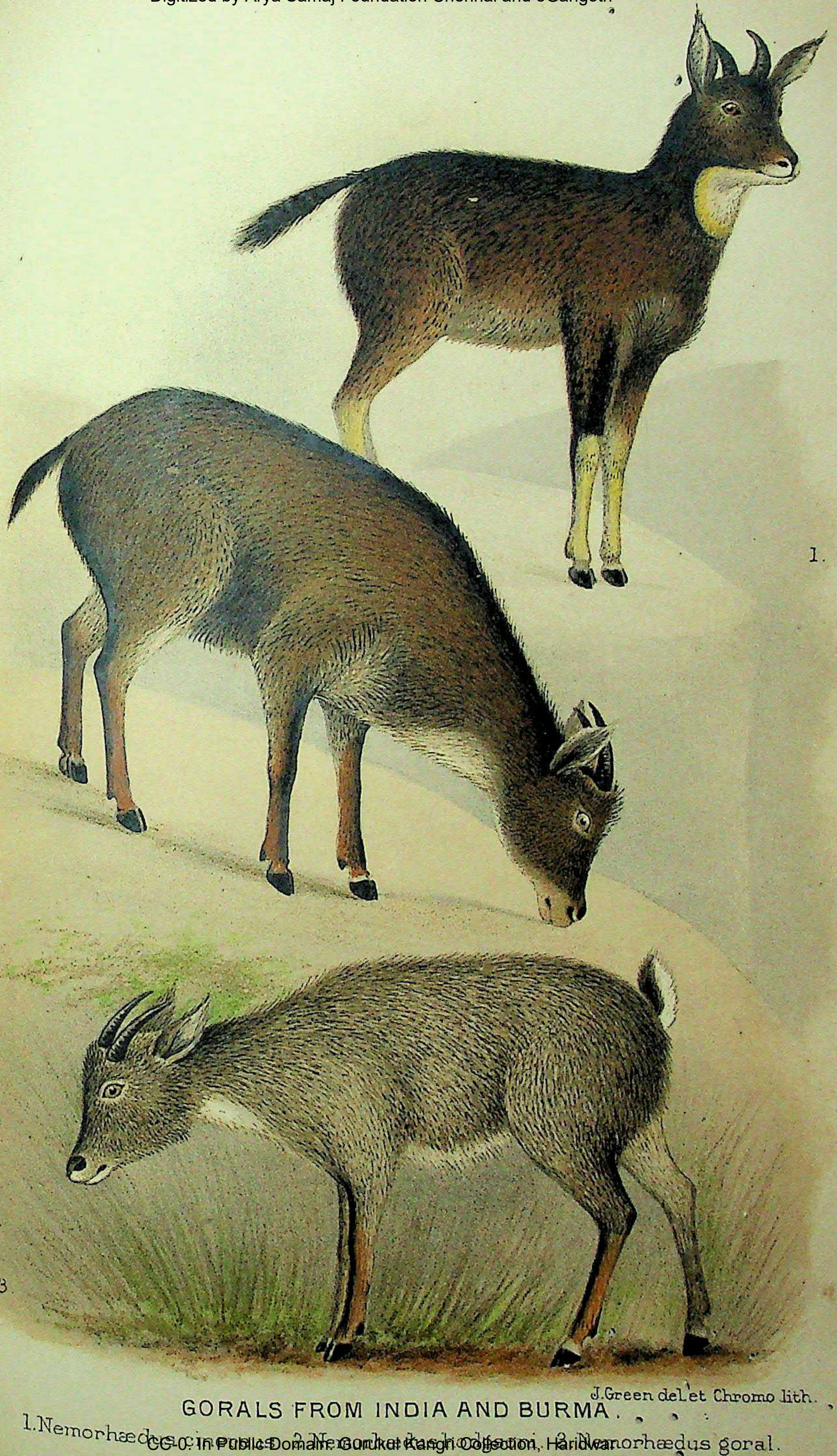
Of this Goral there are in the British Museum complete skins obtained by Hodgson in Nepal and one, the type, shot by Blanford in Sikhim.

The Burmese Goral.

Næmorhedus griseus, Milne-edwards.

Antilope (*Næmorhedus*) *griseus* A. M. Edwards, Nouv. Arch. Mus. VII, Bull, p. 93.; *id.* Rech. Mamm. I, p. 361, pl. 71, fig. 2-2a, pl. 71a, fig. 1, 1874.

? *Antilope* (*Nemorhædus*) *cinerea*, A. M. Edwards, Rech. Mamm. p. 362, pl. 70, pl. 71, fig. 1, pl. 72, fig. 2, 1874.



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GORALS FROM INDIA AND BURMA.

1. Nemorhædus cinereus. 2. Nemorhædus hodgsoni. 3. Nemorhædus goral.

Kemas henryanus, Henry, Proc. Zool. Soc. 1890, p. 93.

Urotragus evansi, Lydekker, Zoologist (4), IX, p. 83, 1905; *id.* The Game Animals of India, etc., p. 153, 1907; Evans, Proc. Zool. Soc. 1905, p. 311.

Nemorhædus griseus, Pocock, Proc. Zool. Soc. 1908, pp. 199-202.

Distinguishable from the two Himalayan forms above described by two main characters; the skin of the tail is about five inches long in the adult and the black stripe on the foreleg instead of passing over the knee and running down the middle line of the cannon bone to the fetlock, turns aside at the knee and usually passes down the outer side of the cannon bone to the false hoof and spreads thence on to the back of the fetlock and pastern.

The colour varies considerably individually from a dirty yellow or greyish-brown to a rich dark brown and a black spinal stripe may be distinctly defined or scarcely traceable. The hairs of the tail are black above and below and the entire tail with its long fringing hairs may reach a length of ten inches. The pale patch on the throat is tinged with yellow, especially marginally. The lower portion of the foreleg is blackish externally and behind, the knee and the inner side of this part of the limb being pale. The corresponding area of the hind leg is brownish behind and fawn or greyish fawn in front. The fetlocks and pasterns themselves vary in colour from ferruginous to fawn or white irrespective of season and sex.

Distribution.—Eastern Tibet (Moupin) Szechuen and Ichang in Southern China to Arakan in Burma. ? Assam.

Nemorhædus griseus was based upon a specimen from Moupin in Eastern Tibet. Subsequently Milne-Edwards described under the name *cinereus*, another species from the same locality, regarding the two as distinct because of certain differences in the skull and teeth. But since the example of *griseus* was a comparatively young animal with the teeth unworn and the last molar not entirely erupted, while that of *cinereus* was quite old with the teeth much worn, it is in the highest degree probable, in my opinion, that the differences relied upon were due to age.

In the British Museum there are several specimens of Gorals from Southern China which seem to be inseparable from *N. griseus*. Some of these are from Szechuen and others from Ichang. These exhibit very instructive individual variation in colour. One male example shot in Ichang on September 9th has a poor coat of a dirty yellow brown colour, with a very distinct black spinal stripe and the feet rusty yellow. Another, also a male, shot on the same day, has the coat mixed brown and grey, no distinct spinal stripe and the feet white. A third, also a male, shot in December, has the coat richer brown with the spinal stripe less distinct than in the first specimen, the feet fawn, that is to say, paler than in the first and darker than in the second, and the throat patch yellower than in either. Again in one of two examples from Szechuen the feet are fawn, in the other they are nearly white. They were shot in January and the colour of the coat is like that of the example shot in December in Ichang. Since the type of *N. henryanus* came from Ichang, there is very little doubt that it was identical with the above mentioned examples from that locality in the British Museum.

Now as to the form from Arakan described by Mr. Lydekker as *Urotragus evansi*. In the summer of 1903 Mrs. Mumford sent me for identification the incomplete skins of some Gorals shot by the late Mr. G. E. Mumford at Kyauk-pin-daung in the Arakan Hills. (see *supra* p. 307). These I was unable to distinguish specifically from the above mentioned skins in the British Museum from Szechuen and Ichang and I consequently identified the Arakan Goral as *Nœmorhedus griseus*. The late Col. Bingham to whom I showed them told me he had long been aware of the existence of Goral in Burma, but supposed them to be identical with the Himalayan animal.

Two years later Major Evans brought the skins and skulls of two young specimens from Mt. Victoria in the Pokokku district of Arakan. These fell into the hands of Mr. Lydekker, who noting certain differences between them and Nepalese Goral and overlooking the likelihood of their resembling Goral from Southern China, described them as a new species which was dedicated to Major Evans. I cannot distinguish these skins specially from those from Ichang and Szechuen and even if the latter are wrongly referred to *N. griseus*, the name *henryanus* must be adopted for them in preference to *evansi*.

The existence of a Goral in the Naga Hills, Upper Assam, was recorded by Capt. Butler (Journ., As. Soc., Bengal, XLIV, pl. 1, p. 332). The characters of this Goral are unknown to me; but since the Naga Hills are separated from the Himalayas by the Valley of the Brahmaputra, it is probable that this Goral will prove to be identical with *N. griseus*.

According to Major Evans who has given an interesting account of the distribution and habits of Gorals in Arakan and the neighbouring districts, the animal occurs at an elevation of 3,500 feet in the Chin-Luchai Hills and extends, he believes, on to the Siamese side of the Thaungyin River and about the hills at the headquarters of the Me-Ping. Their habits appear to be exactly the same as those of the Himalayan species. They live in small flocks numbering from four to about a dozen and frequent steep precipitous ground, which combined with their keenness of vision, makes them exceedingly difficult to approach except by expert cragsmen. They feed in the early morning and evening

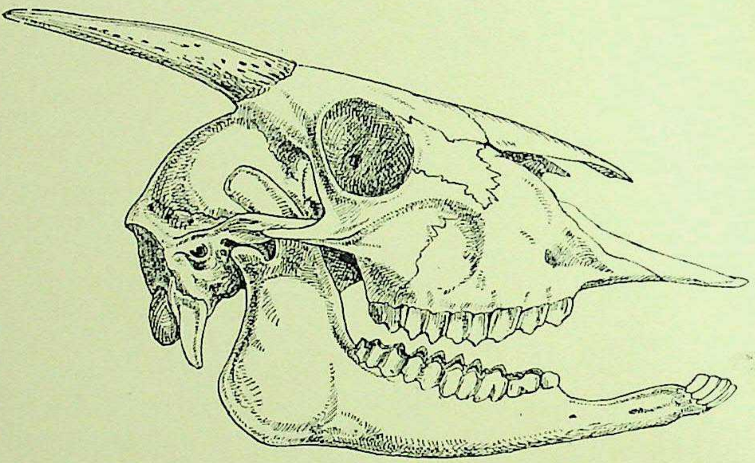

FIG. 1

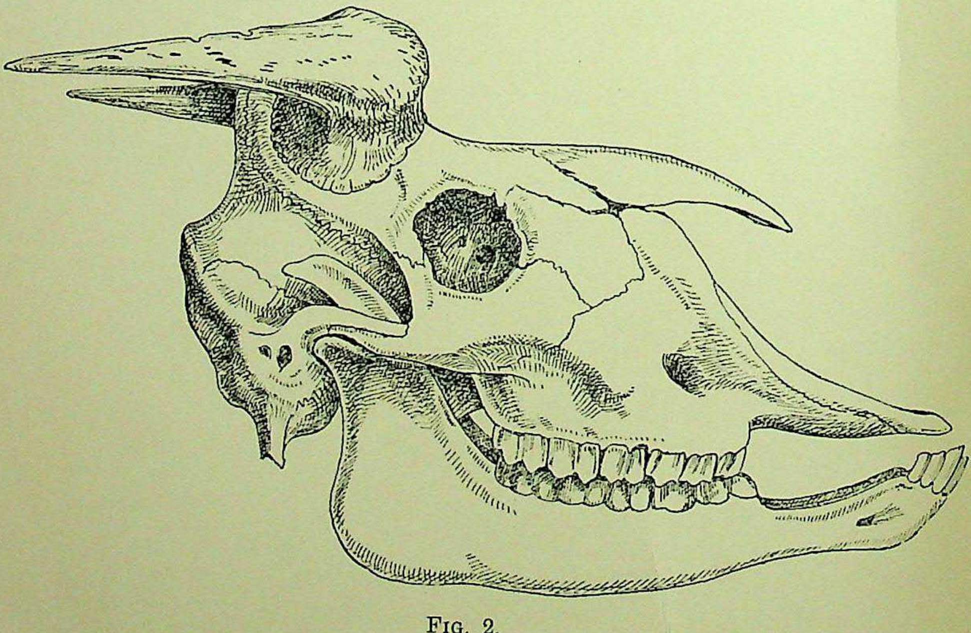

FIG. 2.

SKULLS OF GORAL AND TAKIN.
(Copied from Milne Edward's Rech. Mamm.)

FIG. 1.—SKULL OF THE BURMESE GORAL (*Næmorhedus griseus*).
FIG. 2.—SKULL OF TAKIN FROM EASTERN TIBET (*Budorcas taxicolor tibetanus*).

on grassy patches near their favourite haunts and spend the day resting on inaccessible ledges of rock on the precipitous hill-sides. Their note of alarm is a short sharp hissing or sneezing noise which is immediately taken up by others of the party near by. Their flesh is not bad eating; and the best season to shoot them is from December to May. According to this same observer they stand from 25 to 27 inches at the shoulder; the average length of the horns, which are only slightly longer and thicker in the male than in the female, being about 4 inches or rather over.

Supplementary note on the Takin (*Budorcas*).

In the Journal of the Bombay Natural History Society, Vol. XIX, pp. 812—821, 1910, I gave an account of the described forms of Takins from North India and China. Since then Mr. Oldfield Thomas has described as representing a new species some specimens procured at Tai-pei-San in Shen-si, a province of northern China, naming it *Budorcas bedfordi*, in honour of the Duke of Bedford.

It may be remembered that the prevailing colour of the Assamese and Bhotan Takin (*B. taxicolor*) is blackish brown with the whole of the upper side of the body, apart from the dark spinal stripe, suffused with greyish yellow. At least in the case of old animals it seems that there is considerable variation in colour, possibly of a seasonal nature. The new coat, when it first appears, is brown, and the old coat, when it is ready to be shed, nearly grey. The Bhotan Takin was regarded by Mr. Lydekker as a geographical race distinct from the typical form from the Mishmi Hills, but whether this view prove to be well founded or not, the Takins hitherto discovered in the two districts in question are to all intents and purposes identical.

North of the Eastern Himalayas, in Moupin and Sze-chuen, the Takin just mentioned is replaced by a lighter form (*B. tibetanus*) which is mostly yellow or grey in colour, but retains a blackish patch on the muzzle, black ears and tail, a short dark spinal stripe, and blackish or iron-grey legs. Thus the main characters in which this Southern Chinese animal differs from the Assamese one in the extension of the pale coloration over the greater part of the head, and its intensification everywhere.

In the Shen-si form (*B. bedfordi*) the obliteration of the pigment is carried a stage further. The dark coloration has disappeared from the spinal area and from the tail; but on the muzzle, ears and legs, a varying amount of black persists, at least in some skins as tell-tale marks of affinity between the Shen-si and Sze-chuen types. Where the pigment is least apparent the Shen-si Takin is a beautiful golden yellow colour almost throughout.

It cannot be doubted that the evanescence of the pigment is a derivative and not a primitive character and this view receives the strongest support from the uniformly brown colour of the young both of the Assamese and Sze-chuen animals, the pale colour being added later in life. This being so we may conclude that the comparatively dark North Indian Takin is the least specialised and the Shen-si Takin the most specialised representative of the genus *Budorcas* hitherto discovered.

From what has been said it will be clear that although the Shen-si Takin was described as a new species, it does not differ from previously described Takins in characters of any great moment: and that gradual evanescence of pigment can be traced from the southern to the northern forms.

Speaking of *B. taxicolor* and *B. tibetanus* in my paper quoted above, I said (p. 817): "The two forms indeed are not nearly so distinct from one another as Mr. Lydekker's descriptions would lead one to suppose, and it is quite possible that Milne-Edwards was after all quite right in regarding them merely as local races of one and the same species."

This suspicion arose from the fact that several of the characters relied upon by Mr. Lydekker were shown by the literature of the subject to have no existence in reality and from the impossibility of laying hold of any convincing and definable differences in the skull and horns; the differences of colour, in fact, are practically the only differences to rely upon in distinguishing the animals. And in the *Field*, May 6th, 1911, p. 866, I suggested that there were no logical grounds for regarding the Shen-si and Sze-chuen Takins other than as local races. Quite recently Mr. Lydekker adopted this suggestion (*Field*, October 26th, 1912, p. 860) when writing of some Takins obtained by Mr. Fenwick Owen in Kansu, he said these "Specimens suggest that all the Chinese Takins are local forms of a single specific type." He also said of this Kansu Takin that it "appears to be a whole coloured animal very similar to the Golden Takin (*B. bedfordi*) from Shen-si, but darker in colour." But we know from the typical *B. taxicolor* that the exac shade of colour has no systematic value. Hence it probably ha none in the case of the Chinese forms. A further point to b noticed is this. A Takin from Kansu was described by Mr Lydekker (in Rowland Ward's Records, p. 350, 1907) as *Budarc sinensis*, as I have already pointed out in this Journal (Vol XIX, p 820). But this animal was subsequently regarded by its describe as identical with the Sze-chuen form *B. tibetanus*.

The position then appears to be this. Two kinds of Takins ar alleged to exist in Kansu, namely, *tibetanus* which ranges southward to Sze-chuen and *bedfordi* which ranges eastwards to Shen-si. The possibility of this must be admitted : but, however strong a suspicion one may have that *sinensis* and *bedfordi* will prove to be indistinguishable the available material does not warrant their systematic fusion; but the inference that they are merely racially separable is quite justifiable.

If then we regard all the described Takins as belonging to one species, *Budorcas taxicolor*, the races may be tabulated as follows :

Sub-species *taxicolor*, Hodgson, 1850, Mishmi Hills.
,, *whitei*, Lydekker, 1907, Bhotan.
,, *tibetanus*, M. Edwards, 1874, Sze-chuen.
,, *sinensis*, Lydekker, 1907, Kansu.
,, *bedfordi*, Thomas, 1911, Shen-si.

EXPLANATION OF COLOURED PLATES.

N. B.—The illustrations on the coloured plates representing Serows and Gorals have all been traced from photographs. The shapes and attitudes of the animals are therefore correct. The coloration is not however in all cases quite accurate.

SEROWS FROM BURMA AND MALACCA.

Fig. 1.—The red Burmese Serow (*Capricornis sumatraensis rubidus*). In this figure the white on the throat is overdone and the area above the nostrils should have been black.

Fig. 2.—Robinson's Malayan Serow (*Capricornis sumatraensis robinsoni*). The colour of the eye is doubtful and there should have been more black above the nostrils.

SEROWS FROM THE HIMALAYAS.

Fig. 1.—Jamrach's Serow (*Capricornis sumatraensis jamrachi*) from Darjeeling.

Fig. 2.—Rodon's Serow (*Capricornis sumatraensis rodoni*) from Chamba.

The Nepal Serow (*Capricornis sumatraensis thar*) is intermediate between these two in colour.

GORALS FROM INDIA AND BURMA.

Fig. 1.—The Burmese Goral (*Nœmorhedus griseus* not) *N. cinereus* as labelled on plate.

Fig. 2.—The Brown Himalayan Goral (*Nœmorhedus hodgsoni*) from Nepal and Sikkim.

Fig. 3.—The Grey Himalayan Goral (*Nœmorhedus goral*) from Chamba.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, I.F.S.

PART XIV.

[*Continued from page 100 of Volume XXII.*]

98. Ixias pyrene.—(Pl. J, figs. 65♂, 65*a*♀)—*Dry season brood.*—Male *upperside*: deep sulphur-yellow. Fore wing: base and basal half of costa thickly irrorated with black scales; apical half of the wing black, with an enclosed, large, irregularly triangular, orange-coloured patch, the apex of which is more or less broadly rounded and blunt; the orange colour extends into the apex of the cell but is interrupted there by a black, discocellular spot that spreads diffusely inwards and joins the black, oblique bar which forms the base of the orange patch; veins that traverse this latter, black. Hind wing: uniform with a little black scaling at extreme base; termen with a dusky-black, somewhat narrow border (sometimes entirely absent) which decreases in width posteriorly. *Underside*: a darker yellow, sparsely irrorated with fusco-ferruginous short strigæ and minute spots. Fore wing: base and posterior area broadly similarly irrorated, with a whitish pale virescent tint; the strigæ and minute spots most numerous towards the apex and along the termen; interspaces 4, 5, 6 and 8 with a curved, subapical series of small, rounded dull-ferruginous spots and a similar spot on the discocellulars. Hind wing also with a ferruginous spot on the discocellulars, followed by a postdiscal series of similar spots in interspaces 3 to 8, all or most of them, centred with white; the spots in interspaces 5, 6 and 8 the largest, those in 5 and 6 often coalescent. Antennæ and thorax anteriorly dull-ferruginous; thorax posteriorly and abdomen above, fuscous black; head, thorax and abdomen beneath: yellow. Female *upperside*: white, faintly tinged with yellow. Fore wing: apical half black, with an enclosed, irregular, broad, oblique patch of the ground colour that extends into the upper apex of the cell; on the innerside of this the black is reduced to a short, oblique bar broadened at the lower apex of the cell, from whence it is continued as a somewhat slender, diffuse, oblique streak to the tornus, where it broadens again abruptly and meets the black on the termen; the outer margin of the oblique, white patch is irregularly crenulate, sometimes triannulate; the black colour on the apex often forms a right angle on vein 4; on the white patch posteriorly there is a black spot in interspace 2 and another in interspace 3. Hind wing: uniform, a few subobsolete, slender, fuscous, transverse strigæ posteriorly; the terminal margin sometimes with (more often without) a narrow, dusky-black edging, broadened anteriorly at the apices of the veins. *Underside*: similar to that in the male, with similar markings, the ground-colour a dark, dull ochraceous, the fusco-ferruginous strigæ more numerous. Antennæ, head, thorax and abdomen as in the male.

Wet-season brood.—Male and female *upperside*: differs in the broader, more pronounced, black, terminal edging to the hindwing which is often

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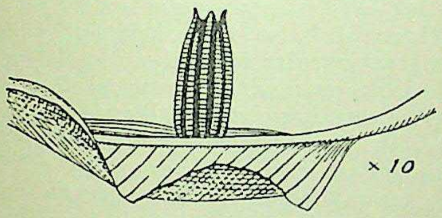
remarkably broad; and in the female by the ground colour which is pale yellow. *Underside*: the fusco-ferruginous strigæ and spots often subobsolete, occasionally entirely absent in the male. Expanse 43-62 mm.

Col. Bingham says that the species was described originally from a dry-season male, probably from China. He states that the insect is most variable in size and colour locally and seasonally; and that the characters peculiar to the dry and wet-season forms are most unstable. It is not uncommon to find specimens with the wet-season character of the broad, black border to the hind wing on the upperside and on the underside with the prominent, fusco-ferruginous, transverse strigæ and spots usually associated with the dry-season forms. Again in the male, the width of the orange patch of the fore wing is very variable. Broadly speaking, however, he says, the males of *I. pyrene* can be divided into two groups mentioned here at the end of "Habits."

Egg.—An egg was laid at about 1 p.m. on the 14th September 1912, on a partly eaten leaf of *Capparis sepiaria* at Pachchapur in the Belgaum District of the Bombay Presidency; it was pearl-white in colour and shiny; it turned pale cream-colour the second day; pale pink blotches and spots appeared all over it on the 16th, but these were not very dense. The little larva emerged about 7 o'clock on the morning of the 18th. The egg is more or less bottle-shaped as in the margin has 12 longitudinal ridges or ribs from top to bottom, of which the 1st and 4th sometimes, or the 1st and 3rd sometimes, anastomose before the top, finishing then, thus joined, in a little free tooth; the teeth forming a narrow ring or crown to the egg; the intervening ridges, when two, run into each other or into one of the ones that reach the top. Always 6, or half the number, seemingly, reach the top as teeth. The ridges are thin, round-edged, and the intervals between, double the breadth of the ridges, are concave and finely, transversely striated with some 30 or more parallel, fine, low cross-ridges. The points or teeth are fairly long, the intervals between them rounded. L: 1·5 mm.; B: 0·6 mm.

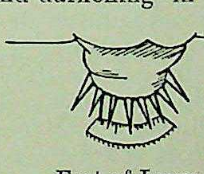


Larva—The little larva emerged about 7 a.m. on the 18th of September and finished the egg-shell by about 10 a.m. as its first meal. Then it began to wander about the leaf. The 2nd stage was 2 mm. in length by 0·5 mm. in breadth and of a translucent ochreous tint, the spines from the subdorsal, dorsolateral, and supraspiracular, large, conical, slightly opaquely white tubercles nearly as long as the larva is broad; those on segment 2, indeed, slightly longer and curved forwards; those on the anal segments somewhat shorter but longer than the majority; all these with little globules of liquid on their ends; other hairs there are also in the subspiracular region but not as stout as those from the above main tubercles. The head more or less round in shape, of the same colour as the body, with dark eyes and jaws and a slight red apical blotch; surface shiny, smooth except for some long, slightly curved (as long as or very little shorter than the majority of the body hairs) hairs in the usual positions. There is a more or less distinct neck, the long tubercle hairs of segment 2 making a very prominent collar behind it. The colour is, as said above, a translucent ochreous-yellow before feeding on the leaf substance, with a red subdorsal shade on segment 9 and on head-vertex; all tubercles slightly opaque-white, the hairs all light except those on the head which are nearly black and one, subspiracular, on segment 2 also black.

3rd stage.—The little larva finished moulting on the night of the 23rd of the month. It had become green before it moulted from eating vegetable matter. It was still green when it finished moulting though slightly less opaquely so. On the 25th morning it was 11 mm. long by something over 1 mm. in breadth; it was shiny green in colour, the head being tinged with yellow; on segments 2, 3, 4, 5, 6, 11 and 12 there were spiracular, dark, chocolate-brown marks, just little spots on the first 3 segments, a good deal larger on segments 5, 6, still larger and nearly coalescing at margins on the last two, including the spiracle on the last four. The tail-points well accentuated, short, diverging, separated narrowly at bases, conical, covered with little erect hairs like the body though slightly longer, proceeding from the somewhat flattened cremastral segment out backwards and in the same plane with it. The head is round, though of course truncated across jaws and that, indeed, somewhat broadly; the clypeus is large, triangular and somewhat depressed; the surface shiny, bearing many, little, brown, erect hairs or bristles all over its surface as well as some few (the usual subdorsal, dorsolateral and lower ones) longer hairs from, each, a light-coloured, conical tubercle; the jaws and eyes dark in colour, the labrum and ligula perhaps lighter than the rest. The surface of body transversely lined as usual, covered somewhat profusely with short, erect, brown hairs which do not, however, hide the surface in the least when viewed from above, these hairs being disposed without order on the intervals between the depressed lines; there are also the prominent white, conical subdorsal, dorsolateral and supraspiracular tubercles of this type of larva, each bearing a longer, erect dark hair with the usual drop of liquid at its tip, though this drop may be wanting occasionally (its presence seems to depend upon the state of health for it is mostly wanting in such larvæ as are stinted in their food); some fine hairs subspiraculary which are light in colour and as long as the main-tubercle ones; there are two less conical, yellowish tubercles below the spiracles; there is a distinct "flange" running the whole length of larva below the spiracles and these are situated upon it. Spiracles oval, of ordinary size, flush, whitish in colour; those of segments 11, 12 larger than rest; those of segment 2 also, of course, larger. The colour of the larva is light grass-green, the ventrum and legs and claspers somewhat lighter still, all shiny; the chocolate spiracular markings very conspicuous, seemingly prominent-convex, shiny.

4th stage.—This was successfully accomplished in the night of the 25th September; the larva was eating the cast skin on the morning of the 26th. On the 28th mid-day it was full grown and then measured 17 mm. by 2 mm. The head semi-elliptical, the lobes fairly well marked, the vertices of lobes rounded; the surface minutely shagreened, covered with short, semi-erect, sharply and slimly conical, brown hairs, all of the same length, distant one from the other about their own length (no longer vertical or facial ones except a few, very slightly longer, about base); clypeus large, triangular, same colour as rest; labrum same colour also; ligula whitish; jaws tipped dark brown; eyes glassy, sometimes partially suffused brown; antennal basal joint green; 2nd joint colourless translucent. Surface of body as in last stage, the main tubercles rather less prominent comparatively with rather (also comparatively to the minute hairs) shorter brown hair to each; the whole surface similarly transversely lined and covered with similar, dark brown, short hairs; the anal segment with the points rather more widely separated by an even rounded sinus in continuation with the inner, lateral outline of each, the points shortly haired with white and brown hairs, the subspiracular region shortly light-haired. The spiracles light, thinly bordered with black, surrounded by body-colour somewhat broadly in the chocolate spiracular blotches; the spiracular chocolate line more or less along the whole larva, turning white along segments 13, 14; spiracles of segments 2 and 11, 12 very slightly larger than rest; all oval, flush. Colour of body grass-green, the tops of transverse ridges dotted alternately white and brown not affecting the depressed lines; the main tubercles white; true legs watery-green; prolegs light green, marked slightly with brown; the subdorsal, tubercles of segments 6—11 suffused brown for some distance round bases, forming spots. The above is the end of the stage; the larva has just settled down to begin preparing for the moult which will bring it into the 5th stage; it is 2 o'clock p.m. of the 28th.

5th stage.—The larva cast its skin on the morning of the 29th at 8 o'clock. On the 1st of September it was as follows:—24 mm. long by 3 mm. broad. Head round, the lobes less distinctly indicated; surface similarly shagreened, covered with minute, shiny, deep-brown, slightly raised points, each bearing a short pointed bristle a little longer than itself, all pointing downwards towards the jaws; clypeus large, triangular, pointed bearing a few brown points with bristles like the rest in its upper half; eyes very prominent; colour of head rather dark grass-green; the labrum green, longitudinally crinkled; the ligula shiny, smooth, light green, antennal basal joint green, 2nd suffused-brownish; jaws dark-tipped; eyes suffused brown; a beginning of a white band through eyes, bordered above and below brown-red representing a continuation of the spiracular band of the body. Surface of body as in the last stage, the main tubercles white, comparatively smaller, with the surmounting hair comparatively even more minute; the rest of body bearing similar, still more minute hairs than in last stage; the tail-points comparatively rather shorter, more widely separated, perhaps blunter; the anal segment well overhanging the anal claspers. The spiracles oval, flush, yellowish-white, thinly dark-bordered, those of segments 2 and 12 much larger than the rest, that of segment 11 slightly larger. Colour of body dark grass-green covered with little dull-red dots; a more or less interrupted, spiracular, white, narrow band, bordered above and below by brownish-red, this brownish-red subsisting, where the white is wanting (on some segments in this particular larva) as an interrupted line broadening and darkening in colour on segments 5, 6, 7; the white band very distinct on segments 10 to end of 14 and along its hinder margin; belly, true legs and prolegs somewhat purer green, the true legs slightly suffused with pink, the prolegs more liberally as regards the extremity of their cylindrical portion, the feet lobed and nearly colourless. The length was 27 mm. by 4·5 mm. just before pupation when the larva became semi-translucent looking. When full grown it sits with the front segments 3, 4, somewhat hunched and the belly resting flat on the surface and then reminds one of the larvæ of *Hebomoia glaucippe.*


Foot of Larva.

Pupa.—The pupa is very like that of *Ixias marianne*; the general shape as to the wide bulge of the ventral wing-outline and snout to head is the same; the inclination of the portion composed of segments 1-4 is generally at an angle of 45° to the rest, sometimes at a much greater angle, up to 75°. The head is mostly composed, as far as visible from above, by the widened base of the "snout," the cylindrical end-half of which, sometimes straight, sometimes turned up, is as long as the widened basal half; the transversely convex segment is not quite as long as this half and both front and hinder margins curve towards each other in dorsal line of pupa, each reaching the dorsal line in an angle, not a curve and this dorsal line is in the same plane as vertex of head, that is, slightly ascending from the longitudinal axis towards thorax; the thorax itself is rather prominently humped, the front slope rather less (though much more than segment 2) inclined away from longitudinal axis than hinder slope is towards it, the curve of the two slopes being wide and even: about an angle of 125° if it might be expressed as an angle; the hinder margin of thorax is a considerable curve meeting the wing-lines on each side in a rather deep, rounded angle of not far off 90° (say 80°); the dorsal line of abdomen is very slightly convexly curved thence to cremaster; the lateral outline of head and segment 2 is a semi-ellipse (apex produced into the snout) placed on the thoracic portion of pupa which is somewhat suddenly broader, sloping shortly to the shoulder bosses where the short, lateral wing-edge ridge takes its origin; the lateral outline of pupa then curves, gently and evenly, slightly inwards (the breadth of pupa decreasing) to about segment 4, then out again as evenly to segment 7, whence the pupa narrows gradually to the cremaster; the ventral outline is slightly convex at head, then very slightly concave (nearly quite straight) up to where it curves largely and widely over the apex of wing-bulge back again to abdomen at segment 8, after which the ventral line of abdomen is a straight line to cremaster; if the line from cremaster to shoulder-point is considered to be the longitudinal axis of pupa, the straight front slope of the wing-bulge curve is at 45° to it; the cremaster is a rather small, square piece with the extreme end a wide rounded sinus leaving a blunt point at either angle, the sinus perhaps about the depth of ¼ or ⅓ of the square piece; this square piece is slightly concave down the middle and is continued along sides of segment 14 (and pupa) in a broad, well-defined, prominent, round-ended extensor-ridge; the ventral surface of cremaster is concave, the whole piece thin dorso-ventrally and there are also two slight ventral, extensor ridges on the undersurface of segment 14, curved towards each other and ending in a little free, blunt point or knob. Spiracles of segment 2 are linear, pointed at ends, flush, rather long, lighter in colour than the pupa; the rest are greyish white, with lighter, narrow, central, raised line and with a fine, raised, green border-line; they are not large, that of segment 11, however, is much larger than the rest, that of 12 is blind. Surface of pupa is very finely punctate on abdomen, imperceptibly corrugate-rough elsewhere, the intervals between the lower parts flat and very little raised; the snout transversly, deeply lined, often seemingly composed of two pieces, one narrower than the other, end to end. Colour light green mottled darker in round dots and spots; the snout, lateral cremastral extensor ridges, dorsal line of thorax (generally carinated slightly), shoulder points, a lateral dot or spot at front margin of each segment (most prominent, sometimes a little patch) on segments 4 and 9, a more or less obsolescent, dorsal, spiracular and central, ventral line, some ventral, abdominal dots, a fascia along inside edge of apical orange wing-patch orange (the area occupied by the orange patch, in the imago that is), a discocellular spot, some powdering on wing-surface: all these some shade of brown, some nearly black others quite light. As often as not the pupa is bone-coloured with the markings black or dusky when the change takes place where the green of the leaves does not affect it. The antennæ only reach to just before apex of wing-bulge curve. L: 20 mm.; B: 5 mm. at middle; H: about 9 mm. at apex of wing bulge, 5 mm. at thorax-apex; L. of snout: 1 mm.

Habits.—The egg is laid single on a leaf, dead stick or withered part of the plant in any position and the laying is done rapidly; most generally a shaded place is chosen low down on the plant and often right inside amongst the stems and branches, for the plant grows in thickets and very often amongst prickly-pear and *Lantana*. The little larva always eats the egg-shell as its first meal and emerges through the side and generally near the top. It then wanders away and takes up its position on a leaf, either above or below, making a bed of silk to rest on; it is never found on young leaves and always eats fully mature ones, often, indeed, those that are partially withered. At first it eats the surface in little round holes which do not penetrate the whole substance; later on it starts at the side, always lying along the edge of the eaten part. This position is well chosen for the larva is then very difficult to see; and it has the habit of falling off when violently disturbed, keeping, however, an anchor in the shape of a single silk thread by which it climbs back when the danger is over. Although, where the butterfly occurs, it is always plentiful, the larvæ are not easy to find; and when found, they are generally ichneumoned and die like most of those of this type; or, indeed, like most of the larvæ of the typically plain-country butterflies. The pupation takes place in a secluded place, well hidden from outside and the chrysalis is attached very strongly by the tail and hangs in a loop just long enough to allow the ventral surface of the abdomen to move without touching the branches or object wherefrom it is suspended. The larva is somewhat sluggish, always moving slowly and haltingly; the pupa wriggles slowly from side to side in a jerking manner when disturbed. The butterfly is a fairly fast flier and delights in the sun; it goes readily to flowers and rests on leaves of bushes and trees at rather long intervals. In the evenings or in dull weather it retires to places low down among the leaves in the thickets which characterise its haunts; it then sits with the wings closed over the back and the front ones drawn into the hinder ones. The flight is generally hurried, more or less straight and varies little from an even, strong fluttering motion of the wings. The butterfly is, as a rule, found in the open country and about the bases of hills in scrub-jungle where there is much tangled vegetation; it seems to be particularly partial to places where prickly-pear (*Opuntia dillenii*) abounds. It is not found in the Bombay Presidency in Kanara on the coast; but is common in Bandra near the city of Bombay close to the sea and is plentiful throughout the Dharwar, Sholapur and Bijapur Districts, and in Belgaum east and north. The foodplant of the larva is *Capparis sepiaria*, L., and it will not readily eat any other Caper. The distribution of the butterfly is given by Colonel Bingham as "nearly throughout our limits, but not in desert parts; extends to China and the Malayan Subregion." By "our limits" is meant British India. Colonel Bingham says that the insect is so variable that it can be divided into two groups as follows:—

(1) *Pyrene* group.—Forewing with the orange patch on the upperside broad, extended right across the apex of the cell, but in

typical *pyrene* interrupted there by a black discocellular spot. To this group belong *evippe*, Drury, *rhexia*, Fabr., *sesia*, Fabr., and *latifasciata*, Butl.

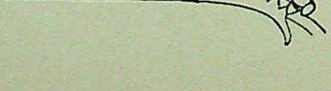
(2) *Pirenassa* group.—Fore wing : with the orange patch on the upperside narrower, extending only into the upper apex of the cell. To this group belong *kausala*, Moore, *satadra*, Moore, *moulmeinensis*, Moore, *frequens*, Butl., *dharmsalæ*, Butl., *watti*, Butl., *cingalensis*, Moore, *jhoda*, Swinh., *alana*, Swinh.

99. **Ixias marianne.**—(Pl. I, fig. 62)—*Wet-season brood.*—Male, *upperside*: chalk-white ; apical half of fore and terminal margin of hindwing broadly black, the black on the latter broadest anteriorly. Fore wing : a broad, rich-orange patch obliquely across the black area extended to the upper apex of the cell, narrowed posteriorly and spread above the tornus into interspace 1 ; opposite the apex of the cell this orange patch is very broad and leaves only the apex of the wing and a comparatively narrow band along the termen and costa black ; base of the wing irrorated with black scales. *Underside* : rich sulphur-yellow as in most of the forms of the genus, irrorated with fusco-ferruginous, short, transverse strigæ and minute dots. Fore wing : the orange patch of the upperside plainly seen by transparency on the disc ; a broadly triangular area below the cell white ; discocellular spot large and prominent, centered with white. Both fore and hindwings with a discal, transverse series of reddish brown spots, in other forms characteristic of the dry-season broods, present and more or less conspicuous, the spots always centred with white ; on the fore wing the patch above the tornus prominent and in some specimens very large. Antennæ reddish-brown, head and thorax anteriorly with reddish-brown hairs, thorax above with white hairs, abdomen black ; beneath : head, thorax and abdomen white.—Female *upperside*: similar. Fore wing : the orange patch on the black apical area narrower, posteriorly truncate, not extended below interspace 2 ; an outer transverse series of four black spots on the orange patch in interspaces 2 to 5. *Underside* as in the male, the markings slightly larger. Antennæ, head, thorax and abdomen similar.

Dry-season brood.—In both sexes this differs less from the wet-season form than it does in *I. pyrene.* The characteristic dry-season markings on the underside are more pronounced, sometimes remarkably so. Expanse : 54-56 mm.

Egg.—Is of the usual shape, that is, shaped like a bottle, with a very short neck ; rather slight, with 11 longitudinal, fine ridges, the intervals between them concave ; some 6 of these ridges, reaching the somewhat thickened ring round the narrow top as little white teeth ; the neck of the bottle affecting ¼ of the height ; surface finely, tranversely striated parallelly, shiny. Colour light yellow when laid, turning flesh-coloured. H : 1·5 mm.; B : nearly 0·5 mm.

Larva.—First stage.—1·5 mm. in length when born, ochreous in colour the head black or yellow, round, with black tubercles and short black hairs. Body cylindrical, anal segment bifurcated ; surface more or less sparsely covered with erect bristles, each with a drop of liquid at its extremity. Colour yellowish with sign of a dark-purplish, spiracular band.



2nd stage.—Head shiny, bristled, green, speckled with brown; body with rows of little bristles transversely across each segment, mottled with brown, otherwise green; tail points well developed.

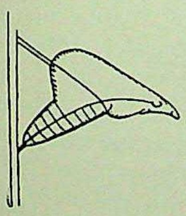
3rd stage.—Head same as in last stage; body covered densely with small bristles of a brown colour; reddish-brown spiracular band, darker round the spiracles which are placed on it; otherwise the colour of larva is green.

4th stage.—The head is round, somewhat rugose as to surface, covered with short bristles which are brown on upper part, longer and white around base. The body is broadest immediately behind the head: about segments 3 and 4, narrowing to the narrow anal segment which ends in two contiguous, short, triangular teeth thickened at ends and set with small, brown bristles; these teeth transparent at ends and red-brown at base. The surface of body is covered with very minute, brown bristles nearly all of one size. The colour is grass-green with a spiracular, yellow, narrow band bordered narrowly by red-brown below and more faintly above, stretching from end to end of larva; abdomen bluish green.

5th stage.—The same as above; head and body covered with very minute, brown bristles amongst which the main-tubercle bristles are hardly perceptible by their slightly greater length; anal segment trapeze-shaped, the cremaster itself or the part that becomes the cremaster in the pupa being nearly square, the tail-points short but very evident. Spiracles small, nearly flush (perhaps sunk a little), oval, light in colour. L: 28mm.; B: nearly 5mm.

The larva is somewhat broadened out in segments 3, 4 and sits with the ventrum closely applied to the resting surface at times in the manner of that of *Hebomoia glaucippe*.

Pupa.—Is of the same shape as that of *I. pyrene* described above having the same large parabolic wing-bulge; the head process slightly curved back (sometimes straight), rather long, cylindrical with conical base. Segment 2 straight as to front margin, the hinder margin concave towards the head; the piece composed of head and segment 2 is trapeze-shaped from above and triangular from side view; the front part of pupa, composed of segments 1-3, is thrown back at an angle of about 75° to the plane of the abdominal axis, so that the hinder dorsal slope of the humped thorax is inclined to segment 4, 5 at an angle of, say, 110°; the front slope of thorax less steep, the apex broadly rounded; sides of thorax (lateral outline of pupa there) very slightly convex; wings slightly expanded behind shoulders where the pupa is broadest; dorsal line of abdomen slightly convex, ventral line slightly concave. The cremaster is square, bifid, the depth of sinus separating the two points being $\frac{1}{3}$ the length of it; each point is bluntly rounded; the ventral extensor-ridges are parallel and end each in a small free point. The antennæ reach to just before the apex of wing-bulge. Surface of pupa like that of *I. pyrenne*; the shoulders with a slight tubercle. Spiracles of segment 2 indicated by a flat, narrow, light coloured surface let in between the margins of segments 2, 3; the others nearly flush with a medial, raised, narrowly oval, lighter centre which has got a depressed line down its longer diameter but posterior to the middle of it; spiracle of segment 11 not larger than rest; that of segment 12 blind. Colour of pupa livid bone-colour, speckled, dotted and slightly blotched with ochreous brown; the lateral line from shoulders to end of cremaster (sub-spiracular to hinder margin of segment 5, thence supraspiracular to end) is very much darker, especially along segments 3-5 and 10-14; the snout



also, and apex of thorax, dark; a darkish, dorsal line; a black speck in front of each spiracle and another, lateral, near front margin of each segment; cell-spot on wings deep brown; the broad, square-ended strong, lateral extensor-ridges of cremaster as well as snout pinkish, dotted with black. The colour may be green marked with dark reddish-brown. L: 19 mm.; B: 5 mm.; H. at wingbulge: 9 mm.; L. of ventral line from tip of snout to apex of wing-bulge: 14 mm.; from apex of wing-bulge to end at segment 9: 6mm.

Habits.—The egg is laid on the wood or on a thorn, or on a leaf, either on the upper or under surface; and always singly. The larva lives generally on the upperside of a leaf in the normal manner but feeds lying along the side or along the part previously eaten, like *I. pyrene* and the *Pareronia* larvæ. In the last two stages, it wanders about a good deal and rests on stalks and branches; it feeds on tender leaves; it is sluggish in its movements. The pupa is formed under a leaf or from a leaf and stalk, the tail attached to the stalk, the body-band to the underside of the leaf; the attachments are strong, the body-loop rather lax. The position chosen for pupation is generally fairly open, not amongst thick foliage and branches as preferred by *I. pyrene*. The butterfly is on the whole much more of an open-space insect than *I. pyrene* and may be seen right away from jungle in the open country flying along the "bands" (boundary-ridges) between the fields in the black-soil plains, though it is also found with the other species in scrub-jungle areas. It is never as plentiful as the other species where they are found together but is plentiful where it occurs. It is a better flier than the other on the whole and is fond of the sun, often goes to flowers and is easy to catch when so engaged. The female is never nearly so plentiful as the male; out of every dozen caught perhaps one will be of that sex. The flight is the same as that of *I. pyrene* though, as said before, perhaps stronger and faster; the butterfly rests in the same way. The foodplants are all Capers: *Capparis sepiaria, Capparis divaricate, C. aphylla, C. grandis* are plants it has been bred upon. Its distribution is N. W. Himalayas as far east as Kumaon; Punjab; Bengal; Central, Western and Southern India; Ceylon.

100. Ixias nola.—Very closely resembles *I. marianne* in both sexes, but the few specimens Colonel Bingham has seen, he states, are constant in colouration, and differ from *marianne* as follows: Male *upperside*, for wing: orange patch on black apical half narrow, not extended to the discoidal cell at all, the black that borders it on the inner side subobsolete below vein 4. Hind wing: the black, terminal border is much restricted and occupies in some specimens only the anterior third of the terminal margin, in no specimen is there more than a mere indication of it on the posterior portion of the termen. *Underside*: similar to the underside of *I. marianne.* Female *upperside*, fore wing: the orange patch on black apical half still narrower; the black that borders it on the inner side completely interrupted between veins 3 and 4: the outer series of black spots on the orange so conspicuous in *marianne* reduced to one in interspace 3 and another in interspace 4. Hind wing: as in the male.

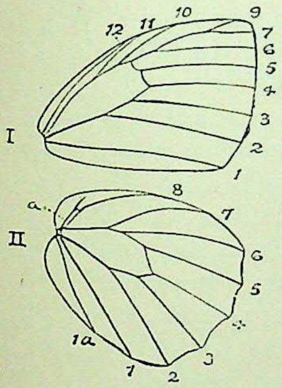
Underside: similar to that in *I. marianne* female. Antennæ, head, thorax and abdomen as in that form.

Expanse 50-55 mm.

The insect has not been bred and it is very doubtful whether it is really a good species; or whether it is not a mere variety of *Ixias marianne*. It has only been recorded from Mahableshwar, a high peak of 3,500′ to 4,500′ of the Western Ghats in the Satara District of the Bombay Presidency. As Colonel Bingham remarks a local observer is wanted who will devote his attention to the breeding of this form, and to that of *I. marianne*, which probably occurs with it.

GENUS APPIAS.

As already once remarked, this genus is in a state of considerable confusion and no two authors are quite agreed even as to the number of species that really exist within the limits of British India. The group *Appias* has been divided into several sub-groups or sub-genera known as *Tachyris*, *Appias*, *Catophaga*, *Hyposcritia* and *Lade*, based upon general faceis or appearance, colouration, &c., and each type is very easily recognizable at sight or by the relative length of the discocellular veinlets. In British India *Lade* contains a single species (*lalassis*) from Burma, Malay, &c., differing from all other members of the group by the falcate apex to the fore wing. *Tachyris* is sufficiently distinguished by being coloured from vermillion to deep crimson-red in both sexes, the only species is *nero* which is found in Sikhim and Assam and eastwards through Burma to the Philippines. The typical *Appias* (consisting of the two species, *hippo* and *libythea* and their local races and varieties) are characterized by the black outer margin not being produced inwardly in interspace 3 on the upperside of the fore wing. These three groups present no difficulty even though the amount and intensity of the black marking may vary greatly according to season: the general pattern of a species always remains the same. The *Hyposcritia* species *indra* and *lalage* with their races or varieties (*indra* with *shiva*, *statilia* and *varendra* and *lalage* with *durvasa*, *argyridina* and *lagela*) can seemingly be separated from all others by the relative lengths of the discocellular veinlets and by the fact that they have either a minute black dot on the discocellular veinlets of the fore wing on the upperside (*indra*) or a large black spot in the lower apex of the cell on the same wing (*lalage*). These last two species are rather like the *Catophaga* lot to look at and it is this *Catophaga* group or sub-genus in which the confusion exists. Colonel Bingham, in the Fauna of British India, gives five species of *Catophaga*: *paulina*, *galathsa*,



Appias hippo, venation.

albina, *leis* and *wardi*. Captain W. H. Evans has just published a "List of Indian Butterflies" in this Journal (March 31st and July 30th, 1912), in which he reduces these to two: *albina* and *melania* (= *leis*), lumping *paulina*, *wardi* and *galathea* under the latter. He may be correct in keeping *albina* (= *darada*, *neumbo*) as a good species. *Leis* and *wardi* are probably the same insect, for the bred series of Kanarese *Catophaga* as also a considerable number of caught males and females are distinctly all referable to one or other of these two forms as described in Colonel Bingham's book, though the Kanarese form does not always agree in every detail with either. *Galathea* and *paulina*, the one from the Andamans and Nicobars, the other from Ceylon, may well be local races of the same *melania-lèis*. There is one somewhat suspicious fact connected with the name of *venusta* which is one of the recognized races or varieties of *albina*: where did the name come from? Why was it given? When it is noted that the foodplant of the larva of *leis-wardi* is *H. venusta* it would seem that the butterfly *venusta* must have been named after the plant, although there is nothing on record to show that this is the case; therefore also, it is probable that either this form or its larva was found at the tree or feeding on it. That is the probabilities would be that the larvæ of *wardi-leis* and of *albina* feed upon the same plant, and might therefore possibly be one species or, at least, the forms might be much more nearly related than hitherto has been supposed. It is a pity that only a few species of the genus *Appias* have been bred or are known to have been bred; these are, two belonging to the subgenus *Appias* and one belonging to *Catophaga*; the former from larvæ feeding upon *Capparideæ*, the latter upon *Hemicyclia venusta*, a euphorbiaceous tree. If, for example, *Catophaga albina* larva were to be found feeding upon a Caper it would go far towards fixing its status as a good species. As regards the distribution of the different insects and the inferences to be drawn therefrom, it might be taken for granted that forms widely separated and characteristic of the regions they are found in should be entitled to the status of distinct species; or, at least, distinct races. But the localities given for several of the forms in Colonel Bingham's work are, nearly certainly, not correct and are due to mistakes having been made originally in the determination of particular insects. For example, the locality "Kanara" for *Appias albina* is certainly a mistake; it is based upon de Niceville's faulty determination of a specimen of *leis-wardi* as *neumbo* (one of the recognised *albina* forms); in all probability "Poona" and "Guzarat" for the same species are based upon a similar mistake. It is only natural, when the different insects have been so confused in the past by even the best known authorities, that localities mentioned should also be looked upon with suspicion; and the writer refuses altogether to rely upon "Poona" as given by Captain Evans (probably upon the authority of Colonel Swinhœ) as a possible habitat of *A. indra* (form *shiva*, Swinhoe). On the whole evidence seems to point to the fact that the Group *Catophaga* consists of four Indian species *paulina*, *galathea*, *albina* and Colonel Bingham's *leis-wardi*. We shall only be able to get at definite truth by breeding the different forms.

This has been a somewhat long digression from the strict limits of the subject insects of this paper, but the matter seemed worth considering even though no definite result is reached; every little helps.

101. **Appias libythea.**—*Wet-season brood.*—Male, *upperside*: pure white. Forewing: costa, apex and termen anteriorly very narrowly shaded with dusky black scales, the black colour produced very finely along the veins for a short distance; the rest of the veins white. *Underside*: pure white, the black colour merely indicated along the costa and at apex. Female, *upperside*: white. Forewing: costa, the apex and termen very widely and the discoidal cell dusky black, the black in the cell produced in a broad streak to the black on the termen so as to leave only a short, oval, oblique bar of the ground-colour beyond the cell; the black on the terminal portion of the wing narrows posteriorly and has its inner margin irregular; on the posterior, inner portion of the wing also there is a somewhat diffuse, dusky black streak from base, narrowed outwardly and not extended to the black on the terminal margin. Hindwing, terminal margin more or less broadly black; a shading of dusky black scales that forms a diffuse, sub-costal streak from base and another, more diffuse, obscure streak across the disc that leaves between it and the dark, terminal margin, a series of, posteriorly, very ill-defined markings of the white ground-colour which decrease in size up to interspace 6. *Underside*: white with similar markings that are, however, more diffuse. Forewing with the black along the terminal margin interrupted by a series of streaks of the white gound-colour in the interspaces. Hindwing with the black scaling along the terminal margin very faint, the dusky shading on the basal and discal areas of the wing as on the *upperside*, but more or less obsolescent; a faint tinge of yellow on the humeral angle. Antennæ in both sexes dusky-black, obscurely spotted with white; head, thorax and abdomen above bluish white; beneath white.

Dry-season brood.—Male: similar, but the narrow, black markings on the forewing still more restricted. Female also similar, but the black markings on the *upperside* on the forewing restricted to the upper part of the cell, and the markings on the costa, the apex of the wing and the termen altogether much narrower than in the wet-season form. On the hindwing the markings are restricted to a narrow, macular band along the termen with mere indications of a dusky, detached streak in the middle of the disc. *Underside*: white in both sexes; apex of the forewing and the whole of the hindwing with an ochraceous tint. In the female the black markings of the upperside show through by transparency. Antennæ, head, thorax and abdomen as in the wet-season form. Expanse 54-66 mm.

Egg.—Is of the usual pierid type, like a short-necked bottle. The longitudinal ribs are 10 in number, thin and distant from each other about $\frac{1}{3}$ the width of the somewhat concave intervals between them: every two anastomose just at their upper ends and reach the top of the egg as a minute single point or tooth, there being thus a narrow ring of five teeth as a crown ; the surface between the ribs is finely transversely striated. The colour is pearl-white when first laid, and shiny, becoming later on a fine orange.

Larva.—The body is sub-cylindrical, thickest in middle, fining down somewhat to both ends, though very little forwards ; the anal end is produced beyond the anal claspers, shortly bifid, the points thus formed being set with colourless, translucent, conical tubercles, each bearing a fine hair. Head is round from the front view, slightly narrower than segment 2 when the larva is full grown, rather thick, covered with small, green, shortly cylindrical tubercles, each bearing a fine hair ; yellowish green in colour. The surface of body is, as usual, lined transversely by fine, impressed, parallel lines, about 7 to each segment ; it is covered all over with minute, short, erect, hairs ; the main tubercles represented by small, white spots each bearing a slightly longer, fine hair ; some longer, fine, whitish, sometimes slightly curved hairs along the dorsoventral line beneath spiracles. Spiracles situated above the longitudinal sub-spiracular white line or narrow band, not small for the larva, oval, flush, light in colour. Colour of the body is a rather light yellowish-green, blotched all over closely with light purplish spots with the exception of the head and belly. L : 30 mm ; B : 4 mm.

Pupa. Is of the angulated type of *Huphina*. The head is tucked under segment 2 and has a moderately long snout which is generally only slightly curved. It is very similar to that of *A. hippo* described below. The snout is not so long nor so much curved as in *hippo* ; the largest lateral teeth, those of segment 7, being broader and equilaterally triangular while those in *hippo* are narrowed at points, conical, that is, ; segment 2 is not produced backwards into a lateral tongue on each side as in that species, but has instead a small lateral rounded knob. The spiracles of segment 2, hidden by the tongue in *hippo*, are linear, light and inconspicuous ; other spiracles are large, oval, flush, of the same colour as the body. Colour is light green, often with a brownish shade, there is a lateral, abdominal row of black spots and a subdorsal row of yellow ones, one spot on each side to each segment ; otherwise the pupa is marked as in *hippo*. L : 18 mm ; B : 6 mm at shoulders ; at apex of thorax : 6 mm.

Habits.—The butterfly always lays its eggs singly and nearly always on a young shoot or the upper surface of a leaf. The larva eats the shell on emerging, as usual and takes up its quarters immediately afterwards along the midrib on a bed of silk spun by itself. It continues this habit all through its life though later on it of course chooses larger leaves. It is sluggish but will wriggle and fall when disturbed, keeping, however, a silk anchored to the place whence it has fallen. The larvæ are much subject to parasitism, principally from small hymenopterous insects. They eat much and continuously and grow fast. The pupation takes plant after a short wandering and generally somewhere on the foodplate on a leaf or branch, either on the upperside or underside ; the body-string is short and tight, the tail-fixing strong. Like the larva of *hippo*, this larva also often rests with its true legs bunched and the fore part of the body held in the air. It is, however, often found high up on trees while *hippo* seems to choose much smaller plants whereon to oviposit. The growth is rapid, as said, and from the laying of the egg to the emergence of the imago is sometimes not more than twenty days. The imago is a strong flier and quick, likes the sun, comes sparingly to flowers compared to other *Pieridæ* and generally rest on a leaf some distance from the ground. It keeps its wings closed over the back and, when really at rest, the front ones drawn somewhat into the hinder ones. The flight is the normal, pierid flight: fairly straight; rather busy and always rapid. The males sometimes come to wet places in nallas in numbers, the females hardly ever; indeed, like it is with many butterflies, the females are not seemingly, at first sight, nearly as plentiful as the male; though, on the whole, when a number of insects are bred from caterpillars, the former generally outnumber the latter. *Appias libythea* is typically an insect of the Plains, though it is by no means confined to the open country; it is often, locally, very plentiful from the sea-level upwards in the most jungly parts of hilly forest country on the west coast in the Bombay Presidency where the rainfall amounts often to as much as 200″, perhaps more. The females are very much affected by season and vary from white with little black marking on the upperside in the dry weather to nearly black—a dusky black, never intense—in the seasons when the foodplants offer much juicy nourishment, that is when the leaves are budding and very tender. The hot weather is the season when the duskiest females are commonest. The butterflies like the sun and open spaces and are generally found, in forest country, in the beds of rivers and along their banks where one of the commonest foodplants of their larvæ, *Cratæa raligiosa*, is most plentiful. This small tree seeds copiously and, where it exists, is always abundant in individuals; it is often planted round Mahomedan grave-yards and is considered holy by the followers of the Prophet. It belongs to the Capparidæ. The larva also feeds upon members of the genus *Capparis* as, for example, upon *C. sepiaria*; but has not been actually bred upon others. Colonel Bingham gives the distribution as Panjab; Mussoorie; Delhi; Plains of Bengal; Orissa; Western and Southern India; Ceylon. It also exists in Sind.

102. Appias zelmira.—Male and female differ from *Appias libythea* as follows:—*Wet-season brood.*—Male, *upperside*, fore wing: base with an obscure bluish tint, costa more broadly black; apex and termen with a series of short black streaks along the veins that are dilated along at their inner apices and thus form a more or less, incomplete, transverse, postdiscal, excurved band that is not extended below vein 3. Hindwing with a terminal series of triangular spots at the apices of the veins. *Underside*: pure white. Forewing: markings as on the upperside. Hindwing: all the veins except the basal portion of the median and of veins 5 and 6, conspicuously bordered with black; this gives the appearance of a series of three transverse, black lines that cross the wing, from the posterior one of which other black lines radiate to the termen; humeral angle tinged with yellow:—Female, *upperside*: much as in *libythea*, but the black markings broader, more clearly defined. Forewing: an anterior, subterminal, transverse, series of three or four elongate spots of the white ground colour is conspicuously apparent on the black margin of the wing. Hindwing: the white ground-colour much restricted and appears merely as a comparatively large, upper-discal patch and four or five postdiscal spots, *Underside*: white; the black markings of the upperside show well through by transparency; the areas covered by them are more or less densely irrorated on the hind wing with yellow scales, which are also less densely scattered over the apex of the forewing.

Dry-season brood.—Male, *upperside*: differs from the wet-season form chiefly in the black streaks at the apex and along the anterior portion of the termen on the fore wing which do not extend so far inwards, although the streaks are themselves broader. Hind wing: the series of connected triangular, black spots along the termen reduced to incomplete series of terminal spots, or altogether absent. *Underside*: white with an obscure yellowish tinge on the apex of fore wing and the whole of the hindwing. Forewing with an irroration of black scales along the base of the costa which spread into the cell. Hind wing with a short, diffuse cross-bar of like scales on the disc.—Female, *upperside*: as in the wet-season form but the black markings are more restricted and allow more of the white ground-colour to appear. *Underside*: similar to the underside in the day-season form of the male, but the irroration of black scales on the forewing fills the cell, extends in a narrow streak in interspace 4 and meets an oblique, postdiscal, lunular band of like scales; on the hindwing the discal cross-bar of black scaling broader. Antennæ, head, thorax and abdomen in both sexes and in both seasonal forms as in *libythea*. Expanse 54-68mm.

Habits.—No information as to the breeding of this species is available; but the foodplant of the larva is sure to be a Caper of some sort. The species (Colonel Bingham treats it as a race of *libythea*) is easily distinguished from *libythea* by the border of conspicuous black vein-streaks all round both wings on the upperside in the male. The two species meet in Bengal in the plains. This is broadly speaking, the eastern representative of the western and southern *libythea*. It's distribution, is Sikhim at low elevations; the plains of Bengal; Assam; Burma; Tenasserim; extending into Siam.

103. Appias hippo.—*Wet-season brood*:—Male, *upperside*: white; along the costal margin of the forewing and the terminal margin of the hindwing somewhat broadly bluish, due to the black colour of the underside that shows plainly through; costal margin of forewing irrorated densely on basal half, more sparingly on apical half, with black scales; terminal margins of both fore and hindwings edged with black, this colour produced triangularly inwards along the veins for a short distance; veins of both wings white, subcostal vein and veins above vein 6 on forewing black. *Underside*, forewing: white; extreme base of costa irrorated with black scales, sometimes condensed into a broad edging along the costal margin which is widened at the apex and continued along the terminal margin in a gradually narrowing border to the tornus, the terminal edging inwardly produced along the veins as on the upperside; a large yellow or white oval spot superposed on the black area at apex in interspace 6. Hindwing: sulphur-yellow; veins concolorous; terminal margin with a black edging as on the upperside but much broader though not so prominently produced inwards along the veins. Antennæ black, sparingly dotted with minute, white dots; head, thorax and abdomen white with a bluish tinge. Female, *upperside*: dusky blackish-brown, variegated more or less with white on the forewing in short, somewhat broad streaks in interspaces 1, 2, 4 and 5; these streaks very variable in width and length. Hindwing on the basal, half and along the dorsum broadly white; the extent of the white is very variable and very ill-defined shading imperceptibly into the dusky-brown. *Underside,* fore wing: similar, the white streaks much broader and longer; an additional dusky-white, longitudinal streak along the middle of the cell; base of wing dusted with yellow scales; apex with a large, diffuse, purplish patch. Hindwing: basal two-thirds pale sulphur-yellow; apical third dusky brownish black, the margins of the two colours fairly sharply defined; veins crossing the disc black. Antennæ as in the male; head, thorax and abdomen above with greenish pubescence; beneath: white.

Dry-season Brood.—Male and female: similar to the wet-season form but smaller; in the male, the black edging to the wings both on the upper and undersides is narrower, often markedly so. In the female the differences are more conspicuous in the extreme forms. Specimens captured in the height of the hot weather in specially dry localities resemble the male of the wet-season form except that the irroration of black scales along the costal margin in the latter is replaced by a broad, continuous streak, widened at the apex and continued in a similar manner as in the male along the terminal margin to the tornus, the inward prolongations of the black colour along the veins more marked. On the underside the dry-season female very closely resembles the wet-season male, the only marked difference is the absence of the elongate, oval spot in interspace 6 of the forewing. This form is the *Appias hippoides*; var. *epicœna,* Swinhoe. Between it and the dark wet-season form of the female many intermediate individual specimens can be found in almost every large collection. Expanse 54-82mm.

Race **taprobana,** Moore.—*Wet-season brood* (*latifasciata,* Moore).—Male closely resembles the wet-season form of typical *hippo,* but the colours are brighter; the black, terminal bordering to the wings on both upper and undersides broader, especially on the underside of the hindwing; the yellow also on this wing is of a deeper, more vivid tint. It can, moreover, be discriminated from *hippo* male at once by the subcostal vein and veins 6, 7 and 8 where they cross the yellow ground-colour, which are not concolorous but conspicuously edged with black scales, these latter often form a broad streak along the basal half of vein 7. Female does not differ materially from the wet-season form of the female of *hippo*; but the dusky brown-purplish on the terminal half of hindwing on the underside is always broader than in females of typical *hippo.*

Dry-season brood.—Male can be separated from the typical form as follows:—*Upperside* forewing: vein 6 more or less broadly edged or defined with black. *Underside* hindwing: terminal, black border much broader; subcostal vein and veins 7 and 8 black, not concolorous with the yellow ground-colour. Female differs from the female of *hippo* only by the greater width of the purplish-black, terminal margin of the hindwing on the underside. Antennæ, head, thorax and abdomen in both sexes as in typical *hippo.* Expanse 64-76mm.

The distribution of *hippo* is given as Sikhim, Lower Bengal, Orissa. Assam, Burma, Tenasserim, extending into Siam and China to the east and southwards to the Malay Peninsula and Sumatra. *Taprobana* is chronicled as from Southern India, Malabar, Travancore, Ceylon.

Another race is recognised, inhabiting the Nicobars (also known from the Philippines), which is characterized in Colonel Bingham's key to the species as "male, underside hindwing: pale yellow, veins concolorous with wings at all seasons". This is known as *andrea,* Esscholtz. He says, however, that it is "a slightly differentiated form scarcely established, even as a local race, as yet."

The insect existing in North Kanara District of the Bombay Presidency is not *taprobana*, but *hippo*; many hundreds of specimens have been bred, the majority of them approaching very close to *taprobana*, but not quite agreeing with the description. Specimens bred from larvæ fed on fairly old leaves have the veins on underside of hindwing concolorous with the ground-colour. The males can always be distinguished from the females by the sharp apex to forewing.

Egg.—Cylindrical from base to three-quarters the way up, whence it narrows gradually to the truncated end, 11 or 12 longitudinal ribs which are finely transversely striated; half the number reaching the top where they appear as small teeth, forming a crown; the interspaces between the ribs are also striated transversely and very finely. The colour of the egg is very light green when laid but quickly changes to orange. L: 1·2mm; B: 0·6mm.

Larva.—(Pl. 1, fig. 18).—The body is subcylindrical, narrowing more to anal end than to head; the anal end overhangs the anal claspers and is narrowly and shortly bifid, the points thus formed being conical and covered with conical, colourless, translucent tubercles. Head round, rather thick, somewhat narrower than segment 2 when the larva is fully grown; studded with shiny, black, pointed, conical, tubercles, each surmounted by a short seta or hair, these setæ, or some of them, often carrying a single globule of transparent liquid at the point; some fine, white, longer hairs at base round jaws; colour yellow-green. Surface of body thinly impressed-lined transversely, 7 parallel lines to each segment, the interspaces between each two being occupied by a single row of shiny black tubercles, each row reaching down each side as far as the subspiracular yellow line or narrow band: the tubercles on head, segments 2, 3, 4 being larger than the rest; the body is, besides, covered somewhat profusely with minute, erect, fine hairs, longest in subspiracular region where they are less numerous and lighter in colour. Spiracles rather large, oval, white, situated on the upper margin of the subspiracular yellow band. Colour is dark yellowish-green; there is a yellow, dorsal line and subspiracular, yellow, narrow band; ventrum light watery green. L: 30 mm.; B: 4 mm.

Pupa. (Pl. 1, fig. 18*a*.)—Of the type of *Huphina*; head tucked under segment 2, that is, nearly quite hidden under it from above; with a long, laterally compressed snout, which is much turned up and attenuated at tip. Segment 2 is triangular seen from above, convex and carinated in the dorsal line; the dorsal line produced into two short points anteriorly, these points close together and produced over the base of the snout; the lateral posterior corners of the segment produced into, each, a tonguelike process of circular transverse section which embraces the shoulder and lies along it: this is very characteristic. Thorax high, convex, humped, carinated in middle along dorsal line, the side view thus being triangular, and this apex is situated just behind a line joining the shoulder-points; this carination extends to segment 4, but not beyond it; the shoulders are slightly angled and the pupa is broadest at them; segment 5 dorsally somewhat convex, segment 6 dorsally flat and this flat part is produced out laterally into a narrow ledge overhanging the wing-surfaces and embracing segment 5 slightly with its lateral corners, segment 7 is similar, the ledge being produced out at front margin into a triangular, slightly up-curved tooth of which the base extends, broadened, to the middle of the segment, the end of the tooth being narrowed and conical. The ledge of segments 7 and 8 looses itself in addomen at hinder margin of segment 8.

Segment 6 is somewhat broader in front than behind (because of the lateral ledge). The front lateral corners of segment 8 are also slightly pointed. Segments 7 and 8 are dorsally very slightly convex. The abdomen finishes off posteriorly rather narrowly, the dorsal half-segments are triangular in transverse section because of a abdominal dorsal carination; the ventral half segments are semi-circular in section and meet the dorsal halves in a slight angle or carination; the cremaster is short, triangular, truncated, not or hardly bifid. Surface nearly smooth except for the usual fine, very shallow, irregularly disposed aciculations. Spiracles of segment 2 hidden by the tongue-like process; other spiracles longly oval, white slits. Colour of pupa light green or brownish, with a lateral row of black dots; top of carina of thorax yellow; top of snout black; a black dorsal mark near front margin of segments 9 to 12; underside whitish. L: 18 mm.; B. at shoulders: 6 mm.; H. at apex of thorax: 6·3 mm.

Habits.—The eggs are laid in batches of from 4 to a dozen and more on young shoots or the upper sides of leaves; the larvæ are gregarious until they reach full size when they gradually separate, each one, then, lying in the centre of a leaf along the midrib in the usual style. They eat voraciously, and grow fast in consequence; from the egg to the imago takes only a matter of three weeks. The pupæ are formed in the same way and in similar localities or situations as those of A. *libythea* described above. The larvæ are parasitized in the same way. The butterfly is not quite so much an insect of the plains as *libythea*; it is not quite so common, though, where it is found, it is quite as numerous in individuals as the other. It inhabits similar localities in the jungle countries and hills of Bombay that *libythea* does; but is not nearly so common in the plains, indeed is there rather scarce. It is probable that it is really confined to coast districts throughout its habitat and to beds of rivers, generally preferring wooded localities, eschewing the immediate sea-side, but occurring up to 2,000 or 3,000 feet. The eggs are generally laid upon very low bushes or young plants, on the tender shoots; the butterflies keep low down mostly, near the surface of the ground, often resting on it; but are strong fliers all the same, perhaps even stronger than *libythea*. They do of course rise occasionally above the usual level of flight, but not often, for the female's sphere lies near the ground and males are generally engaged in seeking these. They are not often seen at flowers, but collect at wet spots on the sand or mud in nalla beds in the hot weather and sometimes in such numbers as to nearly obscure the landscape when put up suddenly in a narrow stream; there are always a few *libythea* *Catopsilia* and an odd *Papilio* or two among these drinking parties. As a rule the flight is straight ahead, barring the frequent circling round trees and in amongst the branches in search of females; and is of the usual, jerky, undulating type usual with nearly all the members of the pierid family. The resting position is the same as for *libythea*: wings closed over the back and the forewings drawn into the hind ones, leaving only the yellow under surfaces of the latter and apices of the former exposed. The only plant the larvæ have been bred upon is *Cratæva religiosa* belonging to the botanical family *Capparidæ*. The distribution of the butterfly has been given above both for *hippo* and the form *taprobana*.

104. ***Appias indra.**—*Wet-season brood.*—Male, *upperside*: white. Forewing: base and basal half of costa thickly irrorated with black scales; a minute, black spot on the discocellulars; the apical half of the costa, and the termen above vein 2, broadly black; the inner margin of the black colour broadly produced inwards in interspace 3; three obliquely-placed spots of the ground-colour on the apical area. Hindwing: uniform white with a minute black speck on the discocellulars. *Underside,* forewing: white; costa at base pea-green; beyond with a broad black stripe that curves round and crosses the wing postdiscally to the terminal margin above vein 2; this black band produced prominently inwards in interspace 3; apex of wing beyond the black band yellowish, obscurely dusted with black scales. Hindwing pale yellow, with very obscure postdiscal patches of white; the whole wing irrorated somewhat sparsely with minute black scales; discocellular, 1st black spot more or less conspicuous.—Female *upperside*: white. Forewing: basal area up to nearly the apex of the cell densely irrorated with blackish scales; remainder of the wing black except lower apex of cell, basal two-thirds of interspace 2 and basal third of interspace 3, which are white: apex of wing with two (not three as in male) obliquely-placed, white spots. Hindwing: dusky black, fading inwardly on basal half of wing to diffuse, dusky grey; two or more upper subterminal, white spots. *Underside*: similar to that of the male. Forewing: the yellowish green colour at base more extended: the curved black band that crosses the wing very much broader and produced inwards along the dorsum for a short distance; apical area greenish yellow, with an obscure series of pearly-white patches between it and the black band, a similar short streak on the tornus. Hindwing differs from that of the male in the deeper yellow of the ground-colour, which, however is similarly irrorated with black scales and bars; a conspicuous subterminal series of pearly-white patches. An intermediate form of the female is common, in which the black area on both fore and hindwing is reduced, to a simple terminal edging that spreads diffusely inwards and obscurely encloses a subterminal series of white, diamond-shaped spots. Antennæ in both sexes black, checkered with white spots; head and thorax with bluish-grey hairs; abdomen black with sparse white scaling; beneath: head, thorax and abdomen white.

Dry-season brood.—Male *upperside*; similar to specimens of the wet-season form, but the black colour on costa, apex and termen very much reduced in extent. *Underside*: the black, curved band on forewing very short, often diffuse and obscure; apex of fore and entire hindwing light earthy brown, more or less densely irrorated with black scales that on the hindwing run together in places and form ill-defined, zigzag markings.—Female *upperside*; similar to that of the male. the black on forewing of somewhat greater extent; termen of hindwing obscurely irrorated with black scales. *Underside*: similar to that of the male; the oblique, black band on forewing broader. Antennæ in both sexes dark brown; head with ochraceous-brown, thorax with bluish-grey, hairs; abdomen blackish; beneath: head, thorax and abdomen white. Expanse 54—74 mm.

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* For drawing showing the difference between (*a*) *indra* & (*b*) *narendra*, *see* Vol XXI, p. 1133

Race **narendra,** *Moore.*—A slightly differentiated and more or less local form, notwithstanding that a few specimens from Assam, which should properly belong to *A. indra,* more closely resemble typical *narendra* from South India and Ceylon.

Wet-season brood.—Male, *upperside* : differs chiefly from that of male *indra* in the hindwing, which is bordered narrowly with black along the termen. *Underside* : as in *indra,* but the yellow colour more vivid and the black, bisinuate band that crosses the forewing notably broader.—Female. Differs from female *indra* on the upperside in the restriction of the black colour, which has also its inner margin more clearly defined. No female *narendra* (according to Colonel Bingham) is ever so dark above as the extreme rain-season form of female *indra. Underside* : similar to the underside in *indra* female, but more closely sprinkled with black scales on the hindwing.

Dry-season brood.—The difference between the seasonal forms is less marked than in *A. indra.*—Male, *upperside:* differs in the hindwing which is always margined along the termen, though often very narrowly, with black; his colour also extends shortly in a few lines along the veins. *Underside*: as in *A. indra,* but the shade of brown on apex of forewing and over the whole of the hindwing is darker, the irroration of black scales more dense, the black, bisinuate band that crosses the wing broader.—Female *upperside* : differs from the wet-season from only in the width of the black on the terminal margin of the hindwing, which band is about half as wide as in rainy-season specimens. *Underside* : similar to the underside in female of the wet-season form. Expanse 58-70 mm.

Neither *Appias indra* nor this race *narendra* have been bred as far as is known. The former is distributed over "the Himalayas, Nepal, Sikhim, Bhutan, Lower Bengal, Assam, Burma, Tenasserim, extending to the Malay Peninsula, Cochin China and China." *Narendra* is confined to Southern India, Ceylon and Assam. It is extremely doubtful whether it exists in the Bombay Presidency at all.

105. Appias albina.—*Wet-season brood*:—Male, *upperside* : pure chalk white. Forewing costa, apex and termen irrorated, not very densely, with black scales ; this irroration narrowed on termen posteriorly and not extended to tornus. Hindwing : a much lighter irroration of black scales along posterior portion of termen. *Underside* : apex of forewing and the whole surface of hindwing pale, dull ochraceous, sometimes with a faint pinkish tint, never pale yellow. Female dimorphic ; 1st form *upperside* forewing : white, irrorated at base and up to as far as two-thirds of the cell with blackish scales which give that part a bluish-grey appearance ; costa broadly and apical half of the wing jet-black ; the inner margin of this black area is irregularly curved, extended inwards and forms a right angle on vein 3 ; thence the black area is diffuse and bounded by a straight line terminating on the dorsal margin just before tornal angle and has three, rarely four, yellowish spots, placed in an outward curve preapically up on it. Hindwing : pale yellow, the terminal margin broadly black, this colour extended triangularly up the veins for a short distance ; base and interspaces 1, 2, irrorated with black scales. *Underside* forewing : as on the upperside but the apex a beautiful, nacreous, bluish white ; the oblique curved, black band not broad, its outer margin irregularly zigzag, never evenly curved. Hindwing : the whole surface the some beautiful nacreous, bluish white as the apex of the forewing.

2nd Form: markings as in the 1st form but the ground-colour on the upperside entirely pale yellow. *Underside*: apical half of cell and disc of forewing up to the black band pale sulphur-yellow; the oblique, curved, black band as in the 1st form; interspace a whitish; the rest of the forewing and the entire surface of the hindwing rich chrome-yellow.—Male and female: antennæ dusky black speckled with minute white dots; head in front with dusky greyish-green hairs; abdomen blackish; beneath: thorax yellow in female, white in male, the abdomen white in both sexes.

Dry-season brood.—Male and female *upper* and *undersides*: similar to the same in the wet-season specimens, but in the male the dusting of black scales on the upperside has almost, in some specimens completely, disappeared, while on the underside the ochraceous colouring is much paler. Female: both dimorphs differ but little from the dimorphs of the wet-season form, only on the upperside the black on the apical half of the forewing and on the terminal margin of the hindwing is more restricted, while on the underside the oblique, curved, black band that crosses the forewing is distinctly narrower with a tendency to become diffuse. Expanse 60-74 mm.

Habits.—Nothing is on record as to the habits. The distribution is said to be "Sikhim up to 4,000 feet; Bengal; Western and Southern India as represented by Guzerat, Poona, Kanara, Travancore; Ceylon; the hills of Assam, Burma and Tenasserim; also found in Malacca, Borneo, Sumatra, Java and the Philippines.' Now de Nicéville named the Kanara specimens sent to him, *neumbo* and that is the only authority for the above "Kanara" being given as a locality where *albina* (=*neumbo*) occurs; as remarked already, the insect that occurs in Kanara is *leis* or *wardi* and not *albina*. The locality "Poona" is probably upon Swinhoe's authority; but Swinhoe has made so many mistakes about butterflies and moths occurring in Poona, where he kept his collections and employed collectors, that it is quite probable this is another; although, of course, it is possible that *leis-wardi* may again have been mistaken for *neumbo* (it is the males that are so alike). Guzerat simply *must* be a mistake for both one and the other, *leis-wardi* feeds upon, a fact also already mentioned, a tree that is only found in the evergreen forests in Bombay; and these exist as far north as Khandala which is in the Poona District, but there are none further north, certainly not in Guzerat. That tree is the euphorbiaceous *Hemicyclia venusta*. It is just possible, of course, that *albina*, *leis* and *wardi* may be one variable species occurring from Ceylon right through India wherever there is forest of the requisite description, up through Bengal to Sikhim and Assam and down through Burma and the Malay Peninsula; and right away across the Archepelago to the Philippines. Some rare individuals have been caught in Kanara of female *leis-wardi* which have the apex of the forewing, and the whole hindwing, on the undersides, bright chrome-yellow, nearly orange.

106. Appias leis—*Wet-season brood.*—Male, *upperside*: white. Forewing: base and costa broadly and somewhat thickly irrorated with black scales;

apex broadly black; termen with a series of inwardly pointed, triangular, black spots at the apices of the veins; these spots confluent along the extreme margin; between veins 3 and 6 a short, postdiscal, black line that ends posteriorly in a large black spot in interspace 3; this line confluent along the veins with the black on the termen, the two thus enclosing between them a vertical series of three prominent, white spots. Hindwing: a terminal series of black spots at the apices of the veins, these spots elongate and prominent anteriorly, posteriorly diffuse. *Underside*, forewing: white, apex from above an oblique line that passes through base of vein 6, ochraceous; a very diffuse, black-irrorated, curved, oblique band from costa to termen borders the ochraceous apex; in most specimens this is obsolete or only a trace of it is to be seen; a prominent, large, quadrate, postdiscal spot in interspace 3 and a greenish-yellow tinge at base of wing. Hindwing: entirely ochraceous yellow.—Female, *upperside*: white. Forewing: base up to and a little beyond middle of cell thickly irrorated with black scales which gives these parts a dark grey appearance; costa and a little more than the apical half of the wing jet black; the inner margin of the black irregular, formed into a square, angular projection on vein 3, thence it extends outwards along that vein, crosses transversely to vein 2, below which it projects inwards diffusely in interspace 1 and thence extends obliquely outwards to the dorsum; finally there is an oblique, preapical row of four white spots in pairs enclosed within the black area. Hindwing: the base and a broad band to the tornus thickly irrorated with black scales; terminal third of wing black, the inner margin of the black area curved and diffuse; a slight yellowish-green tinge on dorsal margin and at base. *Underside* forewing; similar to upperside but the cell, except at his lower apical portion, yellowish green; apical area broadly nacreous blue tinged at the extreme apex with greenish. Hindwing; nacreous blue, sometimes pink, the vains and the terminal margin narrowly and diffusely bordered by greenish yellow; curved postdiscal and subterminal, ill-defined and irregular, broad bands purplish black. Antennæ black speckled with white; head and thorax in male with bluish-grey, in female with greenish-grey, long hairs; abdomen greyish black; beneath: thorax yellow, abdomen white. Anal tufts in the male brown.

Dry-season brood.—Male, *upperside*: similar to the wet-season specimens but the black markings on forewing much restricted and often diffuse; the postdiscal, short, black band and the black spot in interspace 3 often only indicated by a few diffuse scales. On the hindwing the terminal series of spots is much less prominent. *Underside*: as in the wet-season form but of the black markings only the square spot in interspace 3 is left. Female, *upper* and *undersides*: very similar to those of the wet-season male. Extreme dry-season specimens lose the postdiscal, short, black band on the forewing. Antennæ, head, thorax and abdomen in both sexes as in the male of the wet-season form. Expanse 48—66mm.

Habits.—There is no record of the breeding of this species, as such. The distribution of *leis* as given by Colonel Bingham is "Burma and Tenasserim." He says he has "seen specimens from Siam, the Malay Peninsula, Java down to Lombok" also.

107. Appias wardi.—*Wet-season brood.*—Male, *upperside*: White. Forewing: base densely and broadly irrorated with black scales which gradually merge, along the costa, into the black, apical area that occupies about one-third of the wing; the inner margin of this area irregular, passing in a curve from costa to vein 4, thence vertically to vein 3 outwards in interspace 2 and irregularly to dorsum; a curved, preapical series of four or five white spots superposed on the black area. Hindwing: slightly irrorated with black scales at base which leave a terminal series of large, somewhat diamond shaped, black sports at the apices of veins 8 to 7. *Underside,* forewing: white, apex butter-yellow; a somewhat narrow, zigzag, curved, irregular, black band from middle of costa to tornus. Hindwing: uniform butter-yellow.—Female, *upperside*: somewhat similar to that in the male but differs in the much greater extent of the black area which occupies the outer apical half of the forewing and on the hindwing forms a broad, continuous, terminal band: the superposed spots on the black area of forewing reduced to two and the irroration of black scales at the bases of the wings more dense; on the hindwing this extends subdorsally to the black, terminal margin. *Underside*: forewing white, basal half of cell suffused with sulphur-yellow; a very broad, curved, black band crosses the wing from costa to tornus, the inner margin of this irregular, the outer margin fairly even; apex pearly bluish-white. Hindwing uniform, pearly bluish-white.

Dry-season brood.—Male, *upperside*: similar to the wet-season form but on the forewing the irroration of black scales at the base and the black on apical area much restricted, the latter in most specimens has a more or less rubbed appearance; the white, præapical spots very ill-defined. Hindwing entirely white, in some specimens with a faint yellowish tinge. *Underside*: forewing white, with a bluish tint broadly along the basal two-thirds of the costal margin; apex butter-yellow; in a few specimens the usual black, curved band that crosses the wing is indicated by a few detached, black scales, but in most is entirely absent. Hindwing uniform butter-yellow. Female, *upperside*: similar to that in the wet-season form but the black area on both wings much restricted just as it is in the male. *Underside*: also similar to that in the wet-season form but on the forewing the curved, black band is very much narrower and the nacreous surface of the hindwing has more or less of a yellowish tinge. In both sexes and in both seasonal forms the antennæ are black minutely speckled with white, the tufted hair on the head and thorax anteriorly greyish-green, abdomen white beneath; head and thorax pale yellowish white, abdomen white. Expanse 65 to 76 mm.

Habits.—This has always been supposed to be the species that is characteristic of the District of North Kanara in the Bombay Presidency, but, as already remarked, the specimens caught and bred there do not tally with the description in all respects, some of them resembling *leis*. But enough has been said about the matter already and, until further experience is gained, the subject will not repay further consideration. The distribution is given by Colonel Bingham as "Kanara and the Nilgiris."

Larva of leis-wardi.—The larva is very like that of *A. hippo,* Cramer, in appearance but is, as a rule, more thickly covered with black tubercles. The body is more or less cylindrical but narrows somewhat in segments 2 and 3, and still more in the anal segments; the anal flap is thick, semicircularly rounded and inclined at an angle of 45 ° to the longitudinal axis of the larva, and has a small, very slightly developed, conical tubercle before the extremity on each side of the dorsal line; the front half of the flap is shiny and black and has some conical tubercles of different sizes all over it, each surmounted by a single, fine hair, there being one subdorsal tubercle larger than the rest; the posterior half is green and smooth except for the tubercle just before the extremity just mentioned; the body is somewhat stouter in the middle; the head is broader than the body at segment 2. Head round, shiny, oily-yellow all over with a rather large, narrow, triangular clypeus; the labrum and antennæ coloured like the rest; the surface covered with small, conical, setiferous, black tubercles, three subdorsal on vertex, two subdorsal on each side of clypeus-apex and one above that apex, about eight besides on each lobe, and a few small, cylindrical points; all tubercles and points surmounted by a fine hair; the eyes are only four in number on each side and are arranged in an arc above the base of the antennæ and are shiny, of the same colour as the rest of the head, generally bordered with black. Surface of body rugose with six transverse rows, from above the spiracular region over the dorsum, of small, shiny, conical, setiferous, black tubercles to each segment; segments 2, 12 and 13 have only a few transverse rows of such tubercles, the front row of each segment is generally composed of larger tubercles than the others and especially the subdorsal tubercle of that first row is generally large, the tubercles of segment 2 nearly render the whole segment black; the surface is shiny as well as the tubercles and has, besides, a few cylindrical, setiferous, black points. Spiracles of the ordinary size, flush, oval and white. The colour of the body is a rather light green, sometimes with a tinge of lilac, with a yellow-white, narrow, spiracular band from segment 2/3 to segment 12 where the band expands somewhat. The black tubercles may sometimes be very small: just black specks. L.: 30 mm; B.: 3·75 mm.

Pupa of leis-wardi.—The pupa is also like that of *A. hippo*, the head process or snout is long, flattened laterally, slightly curved, pointed at the extremity and directed upwards and forwards, sometimes straight out in a line with the axis, sometimes inclined to it; it is as long as segments 4 and 5 together (in the dorsal line); and the edges of the ventral surface are minutely serrated. The front margin of segment 2 is produced into a small subdorsal tooth and the dorsal line is rather strongly carinated; the thorax is highly carinated in the dorsal line, the lateral outline of the carina being a curve which is slightly broken at the apex just before which the carina is double and the edges somewhat minutely serrate; the lateral teeth of segments 6, 7 and 8 are all the same size and pointed; the dorsal line of the abdomen from segment 6, 7 somewhat carinated, the carination splitting down the sides of cremaster on segment 14; the cremaster is rather small, square as seen from above, slightly bifid from the ends of the lateral carina running out behind, this carina continued forwards on to segments 13, 12, 11. The spiracles of segment 2 are thin, yellow lines; the other spiracles are oval, flush and white. The surface of the pupa is shiny, smooth except for a superficial wrinkling, the carina and the teeth; there is a round, blunt, low production of the shoulder. The colour of the pupa is dirty whitish with a pink shade on segments 4-14; the same but transparent-looking on the rest; the snout, the points on segment 2, the teeth of segments 5—7 sometimes and the extremity of the cremaster are black—only the top and lower edge of the snout however; there is a black spot on the hinder margin of segment 2 dorsally, one just behind the shoulder, one lateral on segments 3-12 and one dorsal on the front margins of segments 9 and 10; there is always a semi-circle of 6 darkish, dorsal spots on segments 6 and 7. The colour of the pupa when formed under a leaf is probably green with the markings more or less as above. The ventrum of pupa is always light in colour. L. 21·25 mm.; of which the snout is 2·75 mm.; B. at shoulders: 5 mm.; B. at segment 7 from tip to tip of teeth: 7·5 mm.

Habits.—Eggs are laid on the tender leaves, probably singly though there are generally many larvæ on each tree which looks as if the eggs might be laid in clusters. The larvæ have no habits that distinguish them in any way from those of *A. hippo*. The pupa is generally attached to the underside of a leaf by a strong tail-fixing and a close body-band, or to the trunk of a tree or branch either horizontally or upright. The caterpillars are quick growers, eating continuously; and the pupal stage is of short duration. The butterflies are fast, strong fliers like the rest of the genus and frequent the evergreen parts of the North Kanara District in the Bombay Presidency from sea-level up to 2,500 or 3,000 feet. They are not found in the plain country being seemingly confined to the hill jungles where the rain is heavy. They like the sunshine and may be found drinking in nalla-beds and on muddy roads in the hot weather in great numbers at times, though they do not seem to frequent flowers much; they fly very high and round the tops of the highest trees.

A LIST OF BUTTERFLIES COLLECTED BY CAPTAIN F. M. BAILEY IN WESTERN CHINA, SOUTH-EASTERN TIBET, AND THE MISHMI HILLS, 1911.

BY

RICHARD SOUTH, F. E. S.

With the exception of some twenty-eight species, the butterflies enumerated in the following list (about two hundred and forty species) were collected by Captain Bailey last year when journeying through a previously unsurveyed portion of South-Eastern Tibet and the Mishmi Country.

The collection as a whole is of very great interest, but of course it is to the butterflies from the newly explored region that scientific value more especially attaches.

A number of species new to science, and some new forms of described species, were obtained. In many cases our knowledge of the distribution of species, described from Western China, is much extended.

As some of the localities mentioned may not be shown on maps it may be well to state that between June 6th and June 10th Captain Bailey was East of the Mekong, marching from Batang to Yer-ka-lo. From June 11th to 15th he was between the Mekong and Salween, marching from Yer-ka-lo to Menkong. His route in South-East Tibet, June 16th to July 7th, was Menkong, Drowa Gompa, Sanga Chu-Dzong, Shiuden Gompa, back to Drowa Gompa, thence down to Rima. From July 8 to August 7 he was in the Mishmi country, Rima to Sadiya.

FAMILY—NYMPHALIDÆ.

Sub-Family.—SATYRINÆ.

1. NEOPE SIMULANS.

Neope simulans, Leech, Entom. xxiv., Suppl. p. 66 (1891): Butt., China, Japan and Corea, p. 49, pl. viii, fig. 2, ♂ (1892).

Two male specimens.

Drowa Gompa (10,00 ft.), June 21 and 22.

Var. *confusa*, nov.

Similar to typical *simulans*, Leech, but the general brown colour is somewhat redder in hue; the black markings, especially those of forewings, are more or less obscured, and the yellow markings are more ochreous in tint: the lower yellow spot on the forewings is completely divided, and there is an ochreous spot at the outer extremity of cell of hindwings. On the underside the yellow spot on forewings is not black centred; the pattern on the hindwings is less clearly defined, the neuration is not paler, and the second ocellus is less elongate.

Expanse 70 mm.

One male specimen.

Liu Yang (7,000 ft.), May 9.

2. NEOPE AGRESTIS.

Satyrus agrestis, Oberthür, Etud. d'Entom. ii, p. 27, pl. ii, figs. 3*a*, *b* (1876.)

Neope agrestis, var. *albicans*. Leach, Butt., China, Japan and Corea, p. 54, pl. vii, fig. 7, ♂ (1892).

Several specimens, some of which vary in the direction of var. *albicans*, Leech.

La Gong (10,000 ft.), June 13; Tondu-la (9,000 ft.), June 14; Menkong (1,000 ft.), June 16.

3. NEOPE MUIRHEADII.

Lasiommata muirheadii, Felder, Wien. ent. mon. vi, p. 28 (1862).

Neope muirheadii, var. *felderi*, Leech, Butt. China, Japan and Corea, p. 54, pl. viii, fig. 4, ♂ (1892).

Two specimens; one closely approaching var. *felderi*, Leech, Shing Ting Hsien (1,800 ft.), April 27.

4. TATINGA THIBETANUS.

Satyrus thibetanus, Oberthür, Etud. d'Entom. ii, p. 28, pl. ii, fig. 4 (1876).

Pararge thibetanus, Leech, Butt., China, Japan and Corea, p. 63 (1892).

Ab. *albicans*, nov.

A female specimen in which all the fulvous markings of the type are replaced by white.

Polu (9,653 ft.), July 2.

The typical form of *T. thibetanus* was not obtained.

5. LETHE BAILEYI, sp. n.

♂. Forewings fuscous brown, clouded with blackish on terminal area: a paler spot in the cell, preceded and followed by blackish marks; postmedial band blackish from costa to vein 4, thence velvety black and inwardly oblique to dorsum, slightly contracted below vein 2; three obscure whitish spots on costal area before apex. Hindwings fuscous brown, rather paler on outer third; postmedial line black, outwardly oblique to vein 4, thence curved and dentate to dorsum; subterminal line whitish, inwardly edged with blackish; terminal line ochreous, edged with blackish; fringes pale grey checkered with darker. Underside greyish, slightly ochreous tinged, a pale spot in cell of forewings, edged on each side with dark brown; postmedial line dark brown, obtusely angled above dorsum, area beyond paler, clouded with greyish brown; three white spots towards apex; subterminal line whitish; hindwings traversed by two dark brown lines, the first almost straight from about middle of costa to median nervure along which it turns inwards to base of vein 2, thence curved and dentate to dorsum; the second line rather broad, oblique to vein 4 then incurved, angled at vein 3 and slightly bent at vein 2; a series of seven black spots, each centred with white and ringed with yellowish white, subterminal line and shading as on upper side.

Expanse 60 mm.

Allied to *L. nigrifascia*, Leech.

1 ♂, Loma (11,000 ft.), July 1.

6. LETHE MARGARITÆ.

Lethe margaritæ, Elwes, Proc. Zool. Soc. Lond., 1882, p. 405, pl. 25, fig. i; Bingham, Fauna Brit. Ind., Butt. i., p. 83 (1905).

Dionana margaritæ, Moore, Lep. Ind. i., p. 271, pl. 86, figs. 1-1 *b* (1892).

One male specimen agreeing with Sikkim examples, but the oblique fascia of forewings is obsolescent.

Ta Shian Liang (5,000 ft.), July 29.

7. LETHE KANSA.

Debis kansa, Moore, Cat. Lep. E. I. C. i, p. 220 (1857) : Lep. Ind. i, p. 241, pl. 78, figs. 1-1*b* (1892).

Lethe kansa, Bingham, Fauna Brit. Ind., Butt. i., p. 92 (1905).

One female specimen.

Panye (2,000 ft.), July 26.

8. LETHE VERMA.

Satyrus verma, Kollar, Hügel's Kashmir, iv, p. 447, pl. xvi, figs. 1-2 (1844).

Lethe verma, Leech, Butt., China, Japan and Corea, p. 23 (1892); Bingham, Fauna Brit. Ind., Butt. i, p. 84 (1905).

Tansima verma, Moore, Lep. Ind. i, p. 273, pl. 86, figs. 3-3*b* (1892).

One male specimen.

Ding (2,000 ft.), July 27.

9. LETHE CHANDICA.

Debis chandica, Moore, Cat. Lep. E. I. C. i, p. 219 (1857), Lep. Ind. i, p. 247, pl. 79, figs. 2-2*b* (1892).

Lethe chandica, Leech., Butt., China, Japan, and Corea, p. 19 (1892); Bingham, Fauna Brit. Ind., Butt. i, p. 94 (1905).

One typical male specimen.

Salam Gam (1,000 ft.), July 28.

10. LETHE CONFUSA.

Lethe confusa, Aurivillius, Ent. Tijdsk., 1897, p. 142 ; Bingham, Fauna Brit. Ind., Butt. i, p. 82 (1905).

Three specimens.

Rima (5,500 ft.), July 7 ; Kahup (5,000 ft.), July 15.

11. MYCALESIS PERDICCAS.

Mycalesis perdiccas, Hewitson, Exot, Butt. ii, (Mycalesis) pl.iii, fig. 15, (1862) ; Leech, Butt., China, Japan and Corea, p. 13, pl. ii, fig. 6, ♀ (1892).

Gareris perdiccas, Moore, Trans. Ent. Soc. Lond. 1880, p. 157.

Two specimens.

Lu Ku Pa, Szechuen (3,000 ft.), May 2 (♂); Pangam (2,500 ft.), July 24 (♀).

12. MELANITIS BELA.

Melanitis bela, Moore, Cat. Lep. E. I. C. i, p. 223 (1857) ; Lep. Ind. ii, p. 128, pl. 126, fig. 1, *c*, *d*, *e*, ♂, ♀ (1894).

Cyllo aswa, Moore, Proc. Zool. Soc. Lond., 1865, p. 769.

Melanitis aswa, Leech, Butt., China, Japan and Corea, p. 108 (1892).

Three male specimens and one female.

One example of each sex, referable to *bela*, the dry season form of the species.

Minzong (3,500 ft.), July 19; Muku (3,400 ft.) July 21; Panye (2,000 ft.), July 26.

13. YPTHIMA BALDUS.

Papilio baldus, Fabricius, Syst. Ent. App. p. 829 (1775).

Thymipa baldus, Moore, Lep. Ind. ii, p. 58, pl. 106, figs. 1-1 i (1893).

Ypthima philomela, Leech, Butt., China, Japan and Corea, p. 90 (1892).
Ypthima baldus, Bingham, Fauna Brit. Ind., Butt. i., p. 134 (1905).

Two specimens.

Minzong (3,500 ft.), July 19 ; Salam Gam (3,000 ft.), July 28.

14. YPTHIMA SAKRA.

Ypthima sakra, Moore, Cat. Lep. E. I. C. i, p. 236 (1857) ; Leech, Butt., China, Japan and Corea, p. 83 (1892) ; Bingham, Fauna Brit. Ind., Butt. i, p. 137 (1905).
Thymipa sakra, Moore, Lep. Ind. ii, p. 69. pl. 109, figs. 2-2*b* (1893).

Several specimens agreeing in the main with those from Western China.

One example (Giada) has four large ocelli on the upper side of hindwings.

Giada (9,500 ft.), July 3 ; Tsachung (7,000 ft.), July 4 ; Rima (3,500 ft.), July 7 ; Kahap (5,000 ft.), July 8.

15. YPTHIMA NEWARA.

Ypthima newara, Moore, Proc. Zool. Soc. Lond., 1874, p. 567 ; (*chinensis*) Leech, Butt., China, Japan and Corea, p. 89, pl. x, fig. 5 (1892) ; Bingham, Fauna Brit. Ind., Butt. i, p. 139 (1905).
Pandima newara, Moore, Lep. Ind. ii, p. 87 (1893).

Several specimens.

Salam Gam (4,000 ft.), July 29.

16. YPTHIMA BEAUTEI.

Ypthima beautei, Oberthür, Etud. d'Entom. ix, p. 18, pl. ii. fig. 1 (1884) ; Leech, Butt., China, Japan and Corea, p. 85 (1892).

Three male specimens.

Ridong (12,000 ft.), June 17.

17. YPTHIMA PUTAMDUI, sp. n.

♂. Very closely resembling *Y. beautei*, Oberthür, on upper side, but on the underside the linear markings are different. The antemedial line is barely traceable, the postmedial line is strongly projected outwards between veins 3 and 6, the subterminal line runs in towards the projection thence to termen below costa ; all the lines are darker, narrower, and more crenulate than in *beautei*.

One male specimen.

Nya Chuka (10,000 ft.), May 25.

18. YPTHIMA BAILEYI, sp. n.

♂. In size, and in colour and marking of the upperside similar to *Y. beautei*, Oberthür, but the yellow ring of apical ocellus of forewings somewhat narrower ; the hindwings have two yellow ringed ocelli on terminal area towards tornus, the upper ocellus smaller than the lower. On the underside the transverse lines of hindwings are reddish brown, the middle line is inwardly angled between veins 2 and 4, outwardly angled between veins 4 and 6, and there is a pale greyish patch below the lower angle.

One male specimen.

Batang (10,000 ft.), June 2.

19. YPTHIMA INSOLITA.

Ypthima insolita, Leech, Entom., xxiv, Suppl., p. 66 (1891) ; Butt., China, Japan and Corea, p. 86, pl. ix, fig. 1, ♂ (1892).

Two ♂ specimens. These are smaller than the type, the termen of forewings straighter, the subapical ocellus smaller, and there is no ocellus between veins 2 and 3.

Tondu la (9,000 ft.), June 14.

20. YPTHIMA DROMONIDES.

Ypthima dromonides, Oberthür, Etud. d'Entom. xv, p. 15, pl. ii, fig. 14 (July 1891).

Several specimens; ocelli small, tending to complete absence.

Ching Chi Hsien (6,000 ft.), May 3; Nyachuka (10,000 ft.), May 25; Batang (9,000 ft.), June 6; Gera (9,000 ft.), June 7; Nun Chou (12,500 ft.), June 9; Trong ze (10,000 ft.), June 11; Menkong (8,000 ft.), June 16.

21. YPTHIMA IRIS.

Ypthima iris, Leech, Entom. xxiv, Suppl. p. 57 (June 1891); Butt., China, Japan and Corea, p. 84 (1892).

Five male specimens.

Leng Chu (4,500 ft.), May 7; Ta pen ba (5,000 ft.), May 8.

23. CALLEREBIA MEGALOPS.

Callerebia megalops, Alphéraky, "Iris" 1895, p. 184; Rom. Sur. Lep. ix, p. 108, pl. ix, fig. 2 ♂ (1897).

One example of each sex. As the female appears to be unnoted the Gera specimen is here described.

♀. Paler brown than the male on the upperside; the medial area of forewings tinged with fulvous; the subapical ocellus is larger and set in an ashey-grey cloud. Four ocelli on terminal area of hindwings, each with distinct fulvous ring and white pupil, the 2nd ocellus largest; a fifth ocellus, represented by a white point between veins 6 and 7; the subterminal line more distinct and the fringes paler. Underside similar to that of the male, but the wavy postmedial line of hindwings is inwardly suffused with fulvous and the ocelli are much more distinct.

Nun Chou (12,500 ft.), June 9 (♂); Gera (9,000 ft.), June 7 (♀).

23. CALLEREBIA POLYPHEMUS.

Eebia polyphemus, Oberthür, Etud. d'Entom. ii, p. 33, pl. ii, fig. 2 (1876).

Callerebia orixa, Leech, Butt., China, Japan and Corea, p. 104 (1892).

One male specimen.

Menkong (8,000 ft.), June 16.

24. CALLEREBIA INNUPTA, p. n.

♀. Smoky brown with a slight greyish tinge on the outer third of all the wings. A diffuse tawny streak on subcostal area of forewings, extending from the base to the tawny ringed black subapical spot; the latter subovate, oblique enclosing two white dots; a much smaller tawny ringed black spot, with a white central point, between veins 2 and 3; a blackish shade-like postmedial band is bluntly angled below middle; subterminal band blackish, rather narrow, interrupted by the veins. Hindwings have three white centred black spots between veins 2 and 5, all are ringed with tawny and vary a little in size, the white centre of the upper spot larger than that of either of the other two; subterminal band blackish, interrupted, narrowed towards tornus. Fringes of all the wings pale grey, blackish at ends of veins, preceded by a black line. Underside of forewings reddish tawny on basal two-thirds, greyish marked with black on outer third; postmedian line brownish; ocelli as above but rings yellowish; hindwings greyish, darker freckled; postmedian line dark grey indented near costa coarsly serrate between veins 2 and 6; followed by a grey-clouded yellow band on which are two ocelli, one between veins 2 and 3, the other between veins 4 and 5; subterminal line dark grey, crenulate.

Expanse 56 mm.

Two female specimen.

Near *C. albipunctata*, Leech.

Menkong (8,000 ft.), June 16; Ruta (8,500 ft.), June 16.

In the specimen from Ruta the lower ocellus on forewings, and the middle one on hindwings, are rather larger than in the specimen described.

25. CALLEREBIA BAILEYI, sp. n.

♂. Blackish, terminal area of all the wings whitish sprinkled with blackish brown; this area on hindwings broad and thinly sprinkled; traces of a wavy blackish, subterminal line towards costa; subapical ocellus, margined with tawny, enclosing two white dots set obliquely: tornal ocellus of hindwings ringed with tawny, white pupilled; fringes white. Underside of forewings as above but the apical area is whiter and the ocellus is larger; hindwings white freckled with brownish chiefly on costal half; a small yellow ringed ocellus, with white centre between veins 6 and 7, a smaller one without white centre between veins 5 and 6; two larger ocelli, faintly ringed with yellow and centred with white, before tornus; traces of a brownish subterminal line.

♀. Similar to the male but browner in colour; on the hindwings the upper ocellus is almost, and that between veins 5 and 6 entirely absent; two diffuse brownish lines, the outer bluntly dentate, represent margins of a medial band.

Expanse 60—64 mm. ♂, 60—67 mm. ♀.

Six male specimens and three females.

Allied to *C. annada*, Moore.

The ocelli of upperside vary in size and those of the underside of hindwings vary in number. Where the subapical ocellus of forewings is much reduced in size on the upperside it looses one white pupil, although remaining bipupilated and of normal size on the underside. The brown sprinkling is heavier in some specimens than in others, and in one male (Dichu) it extends over most of the wing.

Drowa Gompa (10,000 ft.), June 26 and July 3 (♀ type); Giada (9,500 ft.), July 2 (♂ type); Chikung (9,000 ft.), July 3 (7 00 ft.), July 4; Dicuh (6,000 ft.), July 8.

26. CALLEREBIA PHYLLIS.

Callerebia phyllis, Leech, Entom. xxiv., Suppl. p. 57 (1891); Butt., China, Japan and Corea, p. 101, pl. ix, fig. 9 (1892.)

One male specimen.

Gera (9,000 ft.), June 7.

27. CALLEREBIA INCONSTANS, sp. n.

♂. Brownish or sooty black with a diffuse, reddish fulvous band on outer area of each wing, not reaching costa or dorsum on either wing; subapical spot black, enclosing two white points. Underside of forewings reddish fulvous, terminal border greyish brown, sprinkled with whitish grey on apical area; an undulated darker transverse line before the apical spot which is rather larger than above; underside of hindwings greyish irrorated with darker; antemedial line brownish, irregular, not distinct; postmedial line brownish, bluntly dentate, outwardly bordered with ochreous; a subterminal series of white points.

♀. Rather paler. Ocellus larger.

Expanse 46 mm.

Closely allied to *C. phyllis*, Leech, but distinguished by the reddish fulvous on terminal area of the wings and by the smaller and much less oblique subapical spot on forewings. On the underside the hindwings are greyer, the postmedial line and the white points on outer area more distinct.

The subapical spot in one specimen (Sanga Chu Dzong) is without white points, and in two specimens (Shiuden) the spot, which is small and round, has only one white point and this central.

Polu (10,000 ft.), June 22 (Type ♂); Loma (11,000 ft.), June 23; Sanga Chu Dzong (12,000 ft.), June 25 and July 1; Shiuden Gompa (13,500 ft.), June 27.

28. Erebia discalis, sp. n.

♂. Blackish brown, forewings, costa yellowish; a reddish tawny dash in the cell extending beyond the black discocellulars to a yellowish patch; subapical ocellus black, minutely white centred; fringes yellowish checkered with blackish towards apex. Underside similar to above but the ocellus of forewing ringed only with yellowish; hindwings tinged with yellowish and mottled with black.

♀. Similar, but the ocellus very small and the reddish tawny in cell does not extend beyond the discocellular.

Expanse 50 mm.

W. of Rong se la (14,000 ft.), June 1, (♀); Kiala (14,700 ft.), June 10 (♂)

Allied to *E. herse*, Gr.-Gr. (Hor. Ross. 1891, p. 457).

29. Pararge majuscula.

Amecera majuscula, Leech, Butt. China, Japan and Corea, p. 67, pl. xii, fig. 6, ♂ (1892).

One male specimen. The fulvous colour in subapical ocellus very pale.

Gera (9,000 ft.), June 7.

30. Aulocera padma.

Satyrus padma, Kollar, Hügel's Kashmir, iv, pt. 2, p. 445, pl. xv, figs. 1, 2 (1848).

Aulocera padma, Leech, Butt. China, Japan and Corea, p. 71 (1892).

One specimen.

Kahao (6,000 ft.), July 8.

31. Aulocera iole.

Oeneis pumilis, var. *iole*, Leech, Butt. China, Japan and Corea, p. 75, pl. xi, fig. 2, ♂ (1892).

Satyrus sybillina, var. *bianor*, Grum-Grshimailo, Hor. Ent. Soc. Ross. xxv, p. 458 (1891).

Several male specimens, intermediate in form between typical *iole* and var. *bianor*.

Ridong (12,000 ft.), June 18; Dokong (13,500 ft.) June 19; Poda (12,000 ft.), June 25.

32. Oeneis buddha.

Oeneis buddha, Grum-Grshimailo, Hor. Ent. Ross. 1891, p. 458; Leech, Butt. China, Japan and Corea, p. 76 (1892).

Five male specimens and one female. Three males and the female (Litang) all exceed the normal size of the species ranging up to 56 mm. in expanse.

Litang (13,800 ft.), May 28; Toutang (14,500 ft.), May 29; Pugo (14,900 ft.), June 29.

33. Cœnonympha sinica.

Cœnonympha sinica, Alphéraky, Rom. Sur. Lép. v., p. 118.

Cœnonympha typhon, var. *tydeus*, Leech, Butt. China, Japan and Corea, p. 97, pl. xi., fig. 3, ♂ (1892).

Four specimens (3 ♂, 1 ♀).

Shiuden Gompa (13,500 ft.), June 29.

Sub-family—AMATHUSINÆ.

34. Nandogea diores.

Thaumantis diores, Double day, Ann. Nat. Hist., 1845, p. 234; Bingham, Fauna Brit. Ind., Butt. i, p. 190, pl. iv, fig. 32 (1905).

Nandogea diores, Moore, Lep. Ind., ii, p. 182, pl. 148, fig. 1, 1*a*, 1*b*, ♂, ♀ (1894).

One male specimen.

Panye (2,000 ft.) July 26.

35. Stichopthalma howqua.

Thaumantis howqua, Westwood, Trans. Ent. Soc. Lond., 1851, p. 174, vol. iv, p. 178, pl. 18, figs. 2, 2*a* (1858).

Stichopthalma howqua, Leech, Butt. China, Japan and Corea, p. 113; var. *suffusa*, pl. i, fig. 3 (1892); Bingham, Fauna Brit. Ind. Butt., i, p. 193 (1905).

One male specimen of a form intermediate between typical examples from India and var. *suffusa*, Leech, from Western China.

Pangam (2,500 ft.), July 24th, 1911.

Sub-family—DANAINÆ.

36. Caduga tytia.

Danais tytia, Gray, Lep. Ind. Nepal., p. 9, pl. ix, fig. 2 (1846); Leech, Butt. China, Japan and Corea, p. i (1892); Bingham, Fauna Brit. Ind., Butt., i, p. 13 (1905).

Caduga tytia, Moore, Lep. Ind., p. 61, pl. xv, figs. 1, 1*c*, ♂, ♀ (1890).

One specimen.

Drowa Gompa (10,000 ft.), June 21.

37. Caduga melaneus.

Papilio melaneus, Cramer, Pap. Exot. 1, pl. xxx, fig. *d*. (1775).

Caduga melaneus, Moore, Lep. Ind., p. 60, pl. xiv, fig. 2, 2*b* (1890); Leech, Butt. China, Japan and Corea, p. 3 (1892).

Danais melanea, Bingham, Fauna Brit. Ind, Butt. i, p. 14 (1905).

One specimen.

Muku (3,400 ft.), July 21.

38. Tirumala septentrionis.

Tirumala septentrionis, Butler, Ent. Mo-Mag., xi, p. 163 (1874); Marshall and de Nicéville, Butt. Ind. i, p. 48, pl. vi, fig. 8 (1882); Leech, Butt. China, Japan and Corea, p. 3 (1892.)

Danais septentrionis, Bingham, Fauna Brit. Ind., Butt. i, p. 17 (1905).

One specimen.

Minzong (3,500 ft.), July 20.

39. TREPSICHROIS MULCIBER.

Papilio mulciber, Cramer, Pap. Exot. ii, pl. 127, figs. *c.*, *d.* (1779).

Trepsichrois linnæi, Leech, Butt. China, Japan and Corea, p. 7 (1892).

Euplœa mulciber, Bingham, Faun. Brit. Ind., Butt. i, p. 45 (1905).

Five male specimens.

Gabu (4,000 ft.), July 17 ; Tinai (4,000 ft.), July 16 ; Tulang (3,500 ft.), July 18; Minzong (3,500 ft.), July 20.

40. PARANTICA MELANOIDES.

Parantica melanoides, Moore, Proc. Zool. Soc. Lond., 1883, p. 247 ; Lep. Ind. i, p. 54, pl. 12, fig. 3, *3a*, ♂, ♀ (1890).

Danais aglea, Bingham, Fauna, Brit. Ind. Butt. i, p. 18 (1905).

Three male specimens.

Minzong (3,500 ft.), July 20; Tila (3,100 ft.), July 23 ; Khupa (2,500 ft.), July 25.

41. DANAIS PLEXIPPUS.

Papilio genutia, Cramer, Pap. Exot. iii, pl. 206 (1779).

Danais genutia, Leech, Butt. China, Japan and Corea, p. 6 (1892).

Salatura genutia, Moore, Lep. Ind. i, p. 45, pl. 10, fig. 1-1*a* (1890).

Danais plexippus, Linn., Bingham, Fauna Brit. Ind., Butt. i, p. 10 (1905).

Several specimens.

Minzong (3,500 ft.), July 20.

SUB-FAMILY—ACRÆCINÆ.

42. PAREBA VESTA.

Papilio vesta, Fabricius, Mant. Ins. ii, p. 14 (1787).

Pareba vesta, Leech, Butt. China, Japan and Corea, p. 114 (1892) ; Moore, Lep. Ind. v, p. 31, pl. 387, figs. 1-1 (1901) ; Bingham, Fauna, Brit. Ind., Butt. i, p. 469 (1905).

One male specimen.

Dichu Nullah (6,000 ft.), July 8.

SUB-FAMILY—NYMPHALINÆ.

43. ARGYNNIS NIPHE.

Papilio niphe, Linn, Syst. Nat. xii, 785 (1767).

Argynnis niphe, Leech, Butt. China, Japan and Corea, p. 243 (1892).

Acidalia hyperbius, Moore, Lep. Ind. iv., p. 232, pl. 373, figs. 1-1 *b* (1900).

Argynnis hyperbius, Bingham, Fauna, Brit. Ind. Butt. i, p. 438, pl. v, fig. 36 (1905).

Several specimens, including both sexes.

Kahao (5,300 ft.), July 7 ; Minzong (3,500 ft.), July 20 ; Khupa (2,500 ft.), July 25.

44. ARGYNNIS LATHONIA.

Papilio lathonia, Linn, Syst. Nat. xii, p. 786 (1767).

Argynnis lathonia, Leech, Butt. China, Japan, and Corea p. 227 (1892).

Argynnis lathonia, Bingham, Fauna, Brit. Ind., Butt. i. p. 441 (1905).

One female specimen.

Ridong (12,500 ft.), June 18.

45. ARGYNNIS GONG.

Argynnis gong, Oberthür, Etud. d'Entom. ix, p. 15, pl. ii, fig. 9 (1884); Leech, Butt. China, Japan and Corea, p. 224 (1892).

Several specimens.

Ridong (12,000 ft.), June 18; W. of Tsongla (13,500 ft.), June 19; Zhashala (14,500 ft.), June 20; Shiuden Gompa (14,000 ft.), June 29.

46. ARGYNNIS ADIPPE.

Papilio adippe, Linn. Syst. Nat. xii, p. 786 (1767).

Argynnis locuples, Butler, Ann. and Mag. Nat. Hist. (5) vii, p. 134 (1879).

Argynnis adippe, Leech, Butt. China, Japan and Corea, p. 232 (1892).

Four male and two female specimens, all referable to *locuples*.

Drowa Gompa (10,000 ft.), June 4; Chikung (7,500 ft.), July 4.

47. MELITÆA JEZABEL.

Melitæa jezabel, Oberthür, Etud. d'Entom. xi, p. 17, pl. ii, fig. 14 (1886); Leech, Butt. China, Japan and Corea, p. 217 (1892).

Four male specimens.

Pugo (14,000 ft.), June 27; Shiuden Gompa (13,500 ft.), June 29; Poda (15,000 ft.), June 30.

48. MELITÆA SIKKIMENSIS.

Melitæa sindura, var., Elwes, Trans. Ent. Soc. Ind. 1888, p. 336.

Mellicta sikkimensis, Moore, Lep. Ind. v, p. 5, pl. 380, figs. 4, 4 *a* (1901).

Melitæa sindura, Bingham, Fauna, Brit. Ind., Butt. i, p. 451 (1905).

Fourteen male specimens and one female. Three of the males (Tsongla) have the hindwings almost entirely black.

Ridong (12,000 ft.), June 18 (♀); West of Tsongla (12,500 ft.), June 19; Zhashala (14,500 ft.), June 20.

49. CYNTHIA EROTA.

Papilio erota, Fabricius, Ent. Syst. iii, p. 76 (1793).

Cynthia erota, Moore, Lep. Ind. iv, p. 188, pl. 354, figs. 1, 1*a*, *b*, *c* (1900); Bingham, Fauna, Brit. Ind., Butt. i, p. 406 (1905).

Three male specimens.

Tashianliang (1,500 ft.), July 31; Dze Pani (1,500 ft.), August 1.

50. KANISKA CANACE.

Papilio canace, Linn, Syst. Nat. xii, p. 779 (1767).

Vanessa canace, Leech, Butt., China, Japan and Corea, p. 255 (1892); Bingham, Fauna, Brit. Ind., Butt. i, p. 371 (1905).

Kaniska canace, Moore, Lep. Ind. iv, p. 92, pl. 315, figs. 1-1*a* (1899).

Two specimens.

Dabla (8,000 ft.), July 4; Kahao (4,800 ft.), July 15.

51. EUVANESSA ANTIOPA.

Papilio antiopa, Linn, Syst. Nat. x, p. 476 (1758).

Vanessa antiopa, Leech, Butt. China, Japan and Corea, p. 256 (1892); Bingham, Fauna, Brit. Ind., Butt. i, p. 370 (1905).

Euvanessa antiopa, Moore, Lép. Ind. iv, p. 83, pl. 316, figs. 1, 1*a* (1899).

One female specimen.

Ta Chien lu (8,400 ft.), May 17.

52. Pyrameis cardui.

Papilio cardui, Linn, Syst. Nat. x, p. 475 (1758).

Pyrameis cardui, Leech, Butt., China, Japan and Corea, p. 251 (1892); Moore, Lep. Ind. iv, p. 105, pl. 320, figs. 2, 2*b* (1899); Bingham, Fauna, Brit. Ind., Butt. i, p. 365 (1905).

Several specimens.

Chin jih ho (Szechuan) (2,000 ft.), April 21; Ramala (13,000 ft.), May 26; Shiuden Gompa (13,500 ft.), June 27; Rima (5,500 ft.), July 7.

53. Pirameis indica.

Papilio atalanta indica, Herbot, Naturs. Schmett. vii, p. 171, pl. clxxx, figs. 1, 2 (1794).

Pyrameis indica, Leech, Butt., China, Japan and Corea, p. 252 (1892); Moore, Lep. Ind. iv, p. 103, pl. 320, fig. 1 (1899); Bingham, Fauna, Brit. Ind., Butt. i, p. 366 (1905).

One male specimen.

Minzong (3,500 ft.), July 20.

54. Vanessa urticæ.

Papilio urticæ, Linn, Syst. Nat. x, p. 477 (1758).

Vanessa urticæ, var. *chinensis,* Leech, Butt., China, Japan and Corea, p. 258, pl. xxv, fig. 1, ♀ (1892).

Vanessa ladakensis, Moore, Ann. and Mag. Nat. Hist. (5) i, p. 227 (1878).

Several specimens all but one are referable to *chinensis.* The exception, a male, agrees with specimens of *ladakensis* from N. E. Tibet in the British Museum.

Liu Yang (7,000 ft.), May 9; Nyachuka (9,000 ft.), May 25; Ponghamo (12,000 ft.), June 2; Batang (9,000 ft.), June 6; Tsong-en (11,000 ft.), June 9; Sangachu Dzong (12,000 ft.), June 30.

55. Polygonia agnicula.

Grapta agnicula, Moore, Proc. Zool. Soc., Lond., 1872, p. 559.

Polygonia agnicula, Moore, Lep. Ind. iv, p. 99, pl. 319, figs. 2, 2 *a, b, c.* (1899).

Vanessa calbum agnicula, Bingham, Fauna, Brit. Ind., Butt. i., p. 372 (1905).

Three specimens.

Shentsang (12,500 ft.), June 1; Panghamo (12,000 ft.), June 7; Sangachu Dzong (12,000 ft.), June 25.

56. Araschnia davidis.

Araschnia davidis, Poujade, Bidd. Soc. Ent. Fr. 1885, p. xciv; Leech, Butt., China, Japan and Corea, p. 274 (1892).

Five male specimens.

Ponghamo (12,000 ft.), June 2; Tondula (9,000 ft.), June 14; Menkong (10,000 ft.), June 16.

57. Araschnia levanoides.

Vanessa prorsoides, var. *levanoides,* Blanchard, Comptes Rend. Acad. Sci. lxxii, p. 810 (1871).

Araschnia prorsoides, Leech, Butt., China, Japan and Corea, p. 273 (1892).

Three male and one female specimens.

Liu Yang (7,000 ft.), June 9.

58. JUNONIA ORITHYIA.

Papilio orithyia, Linn., Syst. Nat. x, p. 473 (1758).

Junonia orithyia, Leech, Butt., China, Japan and Corea, p. 279, pl. xxv, figs. 8-10 (1892); (*ya*) Bingham, Fauna, Brit. Ind., Butt. i, p. 258 (1905).

Seven male and three female specimens.

Chikung (7,500 ft.), July 4; Rima (5,500 ft.), July 7; Kahao (5,000 ft.), July 15.

59. JUNONIA IPHITA.

Papilio iphita, Cramer, Pap. Exot. iii, pl. ccix, figs. *c*, *d* (1779).

Precis iphita, Leech, Butt., China, Japan and Corea, p. 276 (1892); Moore, Lep. Ind. iv, p. 64, pl. 309, figs. 1-1*e* (1899).

One specimen.

Khupa (2,500 ft.), July 25.

60. SYMBRENTHIA SILANA.

Symbrenthia silana, de Nicéville, Journ. Asiatic Soc. Bengal, 1885, p. 117, pl. 2, fig. 9; Moore, Lep. Ind. iv, p. 121, pl. 329, figs. 2, 2*a*, ♂ (1899).

Symbrenthia niphanda, Bingham, Fauna, Brit. Ind., Butt. i, p. 379 (1905).

One male specimen.

Tulang (3,500 ft.), July 18.

61. SYMBRENTHIA HYPOSELIS.

Vanessa hyposelis, Godart, Enc. Mith. ix, Suppl., p. 818 (1823).

Symbrenthia hyposelis, Bingham, Fauna, Brit. Ind., Butt. i, p. 378 (1905).

One male specimen.

Kahao (4,800 ft.), July 18.

62. SYMBRENTHIA HIPPOCLUS.

Papilio hippoclus, Cramer, Pap. Exot. iii, p. 46, pl. ccxx, figs. *c*,*d*, ♂ (1779).

Papilio lucina, Cramer, Pap. Exot. iv, pl. cccxxx, figs. E, F (1780).

Symbrenthia hippoclus, Leech, Butt., China, Japan and Corea, p. 284 (1892).

Symbrenthia lucina, Moore, Lep. Ind. iv, p. 111, pl. 321, figs. 1-1*g* (1899); Bingham, Fauna, Brit. Ind., Butt. i, p. 376 (1905).

Several specimens.

Tulang (3,500 ft.), July 18; Minzong (3,500 ft.), July 19: Panye (2,000 ft.), July 26.

63. CETHOSIA BIBILIS.

Papilio, bibilis, Drury, Ou. Exot. Ent. i., pl. iv., fig. 2 (1770).

Cethosia bibilis, Leech, Butt., China, Japan and Corea, p. 120 (1892); Moore, Lep. Ind. iv, p. 184, pl. 352, figs. 1-1*d* (1900); Bingham, Fauna, Brit. Ind., Butt. i, p. 402 (1905).

One male specimen.

Khupa (2,500 ft.), July 25.

64. KALLIMA INACHIS.

Paphia inachis, Boisduval, Cuv. Régne Anim., Ins. ii, pl. 139, fig. 3 (1836).

Kallima inachis, Leech, Butt., China, Japan and Corea, p. 122 (1892); Moore, Lep. Ind. iv, p. 165, pl. 340, figs. 1-1*c* (1900); Bingham, Fauna, Brit. Ind., Butt., i. p. 394 (1905).

Four male specimens.

Pangam (2,500 ft.), July 24; Khupa (2,500 ft.), July 27; Paiyan River (1,000 ft.), August 6.

65. Apatura namouna.

Apatura namouna, Doubleday, Ann. Mag. Nat. Hist., 1845, p. 178.
Potamis ambica, Moore, Lep. Ind. iii, p. 4 (1896).
Apatura ambica, Bingham, Fauna, Brit. Ind., Butt. i, p. 230 (1905).
One male specimen.
Khupa (2,500 ft.), July 25th, 1911.

66. Naias populi.

Papilio populi, Linn, Syst. Nat. x, p. 476 (1758).
Limenitis populi, Leech, Butt., China, Japan and Corea, p. 187 (1892).
Three male specimens, all of the typical form.
Latrong (10,000 ft.), June 13 ; Menkong (10,000 ft.), June 16.

67. Rehana parisatis.

Apatura parisatis, Westwood, Gen. Diurn. Lep. ii, p. 305 (1850) ; Bingham, Fauna, Brit. Ind., Butt. i, p. 233 (1905).
Rehana parisatis, Moore, Lep. Ind. iii, p. 17, pl. 194, figs. 2-2c. (1896).
Three male specimens.
Tila (3,000 ft.), July 22 ; Khupa (2,500 ft.), July 25 ; Ding Manou (2,000 ft.), July 27.

68. Patsuia sinensium.

Limenitis sinensium, Oberthür, Etud. d'Entom. ii, p. 25, pl. iv, fig. 8 (1876) ; Leech, Butt. China, Japan and Corea, p. 179 (1892).
Four male specimens.
Menkong (10,000 ft.), June 16.

69. Bhagadatta austenia.

Lebadea austenia, Moore, Proc. Zool. Soc. Lond., 1872, p. 560.
Bhagadatta austeniæ, Moore, Lep. Ind. iii., p. 155, pl. 251, figs. 2, 2*a* (1898).
Auzakia austenia, Bingham, Fauna, Brit. Ind., Butt. i, p. 301 (1905).
One male specimen.
Tashianliang (5,000 ft.), July 29.

70. Dichorragia nesseus.

Dichorragia nesseus, Grose Smith, Ann. and Mag. Nat. Hist. (6) xi, p. 217 (1893) ; Rhop. Exot. vol. iii, *Euthalia*, pl. v, figs. 3, 4 (1898) ; Leech, Butt., China, Japan and Corea, p. 653.
Two male specimens.
Menkong (10,000 ft.), June 16.

71. Litinga cottini.

Limenitis cottini, Oberthür, Etud. d'Entom. ix, p. 17, pl. ii, fig. 5 (1884) ; Leech, Butt., China, Japan and Corea, p. 180 (1892).
Four male specimens.
Menkong (10,000 ft.), June 16 ; Drowa Gompa (10,000 ft.), June 21.

72. Neptis aspasia.

Neptis aspasia, Leech, Entom. xxiii, p. 37 (1890) ; Butt., China, Japan and Corea, p. 193, pl. xviii, fig. 5, ♂ (1892).
A female specimen.
Rima (6,000 ft.), July 5.

73. NEPTIS ANANTA.

Neptis ananta, Moore, Cat. Lep. E. I. C. i, p. 166 (1857) ; Bingham, Fauna, Brit. Ind., Butt. i, p. 340 (1905).

Stabrobates ananta, Moore, Lep. Ind. iv, p. 22, pl. 297, figs. 1-1 *g* (1899).

Two male specimens agreeing in form with W. China examples.

Chikung (7,500 ft.), July 4 ; Dichu (6,000 ft.), July 8.

74. NEPTIS MIAH.

Neptis miah, Moore, Cat. Lep. E. I. C. i, p. 164, pl. iv*a*, fig. 1 (1857) ; Leech, Butt., China, Japan and Corea, p. 198, pl. xix, fig. 3 (1892) ; Bingham, Fauna, Brit. Ind., Butt. i, p. 341 (1905).

Two male specimens.

Khupa (2,500 ft.), July 25 ; Pangam (2,500 ft.), July 27.

75. NEPTIS EXTENSA.

Neptis mahendra, var. *extensa*, Leech, Butt., China, Japan and Corea, p. 202 ; pl. xix, fig. 5 (1892).

Two male specimens both referable to *extensa*, Leech.

Drowa Gompa (10,000 ft.), June 22.

76. NEPTIS COLUMELLA.

Papilio columella, Cramer, Pap. Exot. iv (1782).

Andrapana columella, Moore, Lep. Ind. iii, p. 218, pl. 271 (1899).

Neptis ophiana, Moore, Proc. Zool. Soc., Lond. 1872, p. 561.

Neptis columella, Bingham, Fauna, Brit. Ind., Butt. i, p. 326, pl. ix, fig. 66 (1905).

One male of the *ophiana* form.

Kobo (500 ft.), October 15.

77. NEPTIS SANKARA.

Limenitis sankara, Kollar, Hügel's Kashmir, iv, 2, p. 428 (1844).

Bimbisara sankara, Moore, Lep. Ind., iv, p. 4, pl. 289, figs. 1-1*g* (1899).

Neptis sankara, Bingham, Fauna, Brit. Ind., Butt. i, p. 332 (1905).

A male specimen.

Mango (4,000 ft.), July 16.

78. NEPTIS SOMA.

Neptis soma, Moore, Proc. Zool. Soc., Lond., 1858, p. 9, pl. xlix, fig. 6, ♀ : Lep. Ind. iii, p. 241, pl. 284, figs. i-if (1899).

Neptis nandina, Moore, (pt.), Cat. Lep. E. I. C. i, p. 768 (1857).

Three specimens agreeing with a specimen from Darjeeling, labelled "*nandina*, Moore, type," in the British Museum Collection.

The true type of *nandina*, Moore (Cat. Lep. E. I. C. i., pl. iva, fig. 7) is from Java.

Khupa (2,500 ft.), July 25 ; Ding Manon (2,000 ft.), July 27 ; Salamgam (3,000 ft.), July 28.

79. NEPTIS PSEUDOVIKASI.

Bimbisara pseudovikasi, Moore, Lep. Ind. ii, p. 7, pl. 291, figs 1-1*c* (1886).

Neptis vikasi pseudovikasi, Bingham, Fauna, Brit. Ind., Butt. i, p. 33 (1905).

Three male specimens.

Khupa (2,500 ft.), July 25 ; Ding Manon (3,000 ft.), July 27.

80. NEPTIS INTERMEDIA.

Neptis intermedia, Pryer, Rhop. Nihon, p. 24, pl. vi., fig. 1 (1886).
Neptis aceris, Leech, Butt., China, Japan and Corea, p. 203 (1892).

A number of specimens, chiefly males.

Lengchu (4,500 ft.), May 7 ; Tapenba (5,000 ft.), May 8 ; Liu Yang (7,000 ft.), May 9 ; Menkong (10,000 ft.), June 16 ; Tondula (9,000 ft), June 19 ; Drowa Gompa (10,000 ft.), June 22 ; Kahao, July 8.

81. NEPTIS EURYNOME.

Limenitis eurynome, Westwood, Donovan's Ins. China (2nd Ed.), p. 66, pl. 35, fig. 4 (1842).
Neptis astola, Moore, Proc. Zool. Soc., Lond., 1872, p. 560 ; Lep. Ind. iii, p. 227, pl. 274, figs. 1-1*g* (1899).
Neptis eurynome, Bingham, Fauna, Brit. Ind., Butt., i, p. 323, pl. ix, fig. 61 (1905).

Several specimens of the *astola* form.

Kahao (5,000 ft.), July 8 ; Kahao (5,000 ft.), July 15 ; Minzong (3,500 ft.), July 19 ; Pangam (2,500 ft.), July 23.

82. ATHYMA JINA.

Athyma jina, Moore, Cat. Lep. E. I. C. i, p. 172 (1857) ; Leech, Butt., China, Japan and Corea, p. 172 (1892).
Tharasia jinoides, Moore, Lep. Ind. iii, p. 181 (1899).

Two male specimens of the *jinoides* form.

Tila (3,000 ft.), July 22 ; Ding Manon (2,000 ft.), July 27.

83. STIBOCHIONA NICEA.

Adolias nicea, Gray, Lep. Ins. Nepal, p. 13, pl. xii, fig. 1 (1846).
Stibochiona nicea, Leech, Butt., China, Japan and Corea, p. 133 (1892) ; Bingham, Fauna, Brit. Ind., Butt. i, p. 250, pl. vi, fig. 46 (1905).

Several specimens including both sexes.

Tulang (4,000 ft.), July 17 ; Minzong (3,500 ft.), July 19 ; Muku (3,400 ft.), July 21.

84. ADOLIAS DIRTEA.

Papilio dirtea, Fabricius, Ent. Syst. iii, pl. i, p. 59 (1793).
Adolias dirtea, Moore, Lep. Ind. iii, p. 68, pl. 213, figs. 2-2*a* (1897).
Symphædra dirtea, Bingham, Faun. Brit. Ind., Butt. i, p. 253 (1905).

One male specimen.

Khupa (2,500 ft.) July 25.

85. CIRROCHROA AORIS.

Cirrochroa aoris, Doubleday, Gen. Diurn. Lep. i, p. 157, pl. 21, fig. 2 (1847-8) ; Moore, Lep. Ind. iv, p. 212, pl. 364 (1900) ; Bingham, Fauna, Brit. Ind., Butt. i, p. 427 (1905).

Five male specimens and one female.

Minzong (3,500 ft.), July 2 ; Pangam (2,500 ft.), July 22 ; Ding Manon (2,000 ft.), July 27 ; Tashianliang (1,500 ft.), July 31 ; Habong River (1,700 ft.), August 2.

86. CHARAXES MARMAX.

Charaxes marmax Westwood, Cat. Or. Entom., p. 43, pl. 21 (1848) : Bingham, Founa, Birt. Ind., Butt. i. p. 211 (1905).

Haridra marmax, Moore, Lep. Ind. ii, p. 233, pl. 170, figs. 1-1c (1895).

One male agreeing with Sikkim specimens.

Tashianliang (1,500 ft.), July 31.

87. CHARAXES POLYXENA.

Papilio polyxena, Cramer, Pap. Exot. i, pl. liv, figs a, b (1779).

Charaxes pleistonax, Felder, Reise Nov. Lep. iii, p. 443 (1867).

Charaxes jalinder, Butler, Lep. Exot., p. 98, pl. xxxvii, fig. 4 (1872).

Charaxes polyxena, Bingham, Fauna, Brit. Ind., Butt. i, p. 216 (1905).

Two male specimens, one referable to *pleistonax*, Felder, the other two *jalinder*, Butler; also a female of the typical form.

Panye (2,000 ft.), July 20 (*pleistonax*); Dze River (1,500 ft.), August 1 (*jalinder*); Sadiya (500 ft.), October 25.

88. CHARAXES NARCÆUS.

Nymphalis narcæus, Hewitson, Exot. Butt. i, pl. i, figs. 1, 4 (1854).

Charaxes narcæus, Leech, Butt., China, Japan and Corea, p. 126 (1892).

One specimen.

Liu Yang (6,000 ft.), May 9.

89. CHARAXES ATHAMAS.

Papilio athamas, Drury, Ill. Exot. Ent. i, p. 5 (1770.)

Eulepis athamas, Moore, Lep. Ind. ii, p. 252, pl. 184, figs. 1—1d (1896): Bingham, Fauna, Brit. Ind., Butt. i, p. 220 (1905).

Four male specimens.

Minzong (3,500 ft.), July 20; Khupa (2,500 ft.), July 25; Tashianliang (1,500 ft.), July 31.

90. EUTHALIA CONFUCIUS.

Adolias confucius, Westwood, Gen. Diurn. Lep., p. 290 (1850).

Euthalia confucius, Leech, Butt. China, Japan and Corea, p. 135, pl. xxi, fig. 6, ♂ (1892).

Two male specimens.

Tulang hills, (4,000 ft.), July 17; Minzong (3,500 ft.), July 19.

91. EUTHALIA DURGA.

Adolias durga, Moore, Cat. Lep. E. I. C. i, p. 196 (1857.)

Labranga durga, Moore, Lep. Ind. iii, p. 159, pl. 246, figs. 1, 1a, b, ♂, ♀ (1896).

Dophla durga, Bingham, Fauna, Brit. Ind., Butt. i, p. 260 (1905).

Two examples of each sex.

Minzong (3,500 ft.), July 19; Muku (3,400 ft.), July 21; Tila (3,000 ft.) July 22; Panye (2,000 ft.), July 26.

92. SEPHISA CHANDRA.

Castalia chandra, Moore, Cat. Lep., E. I. C. i, p. 200, pl. 6, a, fig. 4, ♂ (1857); Lep. Ind. iii, p. 298, pl. 198.

Sephisa chandra, Bingham, Fauna, Brit. Ind., Butt. i, p. 246 (1905).

A male specimen.

Ding Manon (2,000 ft.), July 27th, 1911.

93. ABROTA GANGA.

Abrota ganga, Moore, Cat. Lep. E. I. C. i, p. 178, pl. 6, a, fig. 1, ♂ (1857); Lep. Ind. iii, p. 81, pl. 219, figs. 1, 1a, (1897); Bingham, Fauna, Brit. Ind., Butt. i, p. 251 (1905).

One male specimen.

Muku (3,900 ft.), July 21.

94. Moduza procris.

Papilio procris, Cramer, Pap. Exot., ii, pl. 106, figs. E, F, ♀ (1777).
Moduza procris, Moore, Lep. Ind., iii, p. 161, pl. 253, fig. 1 (1898); Bingham, Fauna, Brit. Ind., Butt. i, p. 291 (1905).
One female specimen.
Kobo (500 ft.), October 15.

95. Auzakia danava.

Limenitis danava, Moore, Cat. Lep. E. I. C. i, p.180, pl. vi, a fig. 2, (1857): de Nicéville, Butt. Ind., ii, p. 157 (1886); Leech, Butt. China, Japan and Corea, p. 188, pl. xiv, fig. 1, ♂, 1892.
Auzakia danava, Moore, Lep. Ind., iii, p. 149, pl. 249, figs. 1-1c (1896).
One specimen.
Tulang (4,000 ft.), July 17th, 1911.

96. Cyrestis thyodamas.

Cyrestis thyodamas, Boisduval, Cuvier's Règne Animal, Ins. ii, pl. cxxxiii, fig. 4 (1836); Leech, Butt. China, Japan and Corea, p. 248 (1892); Moore, Lep. Ind. iv, p. 48, pl. 306, figs. 1-1c (1899); Bingham, Fauna, Brit. Ind., Butt. i, p. 349 (1905).
Cyrestis chinensis, Martin, Iris, xvi, p. 87 (1903).
Two male specimens.
Tulang (4,000 ft.), July 17.

97. Chersonesia risa.

Cyrestis risa, Doubleday and Westwood, Gen. Diur. Lep. ii, p. 262, pl. 32, fig. 4 (1850).
Chersonesia risa, Moore, Lep. Ind. iv., p. 55, pl. 307, figs. 3, 3a, b, ♂, ♀ (1899).
One specimen.
Panye (2,000 ft.), July 26.

Sub-fam.—PSEUDERGOLINÆ.

98. Pseudergolis wedah.

Ariadne wedah, Kollar, Hügel's Kashmir, iv, pt. 2, p. 437 (1848).
Pseudergolis wedah, de Nicéville, Butt. Ind. ii, p. 120, pl. xxiii, fig. 109 ♂; Leech, Butt., China, p. 275 (1892).
Two male specimens.
Minzong (3,500 ft.), July 20; Tila (3,000 ft.), July 22.

Sub-fam.—LIBYTHEINÆ.

99. Libythea lepita.

Libythea lepita, Moore, Cat. Lep. E. I. C. i, p. 240 (1857); Leech, Butt. China, Japan and Corea, p. 288 (1893).
Three male specimens.
Menkong (10,000 ft.), June 16; Chikung (8,200 ft.), July 11.

Sub-fam.—CALINAGINÆ.

100. Calinaga saka.

Calinaga davidis, Leech, Butt. China, Japan and Corea, pl. xx, fig. 1 (1894).

Calinaga saka, Moore, Lep. Ind. v, p. 49 (1901).
One male specimen, in worn condition.
Menkong, (10,000 ft.), June 16.

FAMILY—PAPILIONIDÆ.

Sub-family—THAIDINÆ.

101. ARMANDIA THAIDINA.

Armandia thaidina, Blanchard, Compt. Rend., lxxii, p. 809 (1871); Leech Butt. China, Japan and Corea, p. 489 (1893).

A male specimen.
Liu Yang (77,000 ft.), May 9.

Sub-family—PARNASSIINÆ.

102. PARNASSIUS SZECHENYII,

Parnassius széchenyii, Frivaldszky, Term. Füz. x, p. 39, pl. iv, figs. 1, 1a, (1886); Leech, Butt. China, Japan and Corea, p. 501 (1893).

Several specimens representing both sexes.
Drika la, (15,000 ft.), May 27; Tizu (13,800 ft.), May 21; Litang 17,000 ft.), May 28.

103. PARNASSIUS ORLEANS.

Parnassius orleans, Oberthür, Etud. d'Entom., xiv, p. 8, pl. i, fig. 2 (1891); xvi, p. 3, pl. ii, fig. 14, ♀ (1892); Leech, Butt., China, Japan and Corea, p. 502 (1893).

Four male specimens identical with those from Ta-chein-lu (Ex coll. Leech) in the British Museum.
Kia la 17,000 ft.), June 10; Tsema la (15,500 ft.), June 17; Zhasha la (15,000 ft.), June 20.

104. PARNASSIUS ACCO BAILEYI, nov.*

Generally larger in size, more strongly marked with black, the red spots richer in colour, and the tornal pair of sub-terminal spots frequently enclose some bluish scales; the fringes of the forewings are always checkered at ends of the veins, and sometimes the fringes of the hindwings are slightly marked in this way.

In expanse the male specimens from Litang range from 62-69 millim, and the females from 60-66 millim. The only specimen, a male, obtained at Rama La measures 76 millim in expanse.

Sixteen specimens (9 ♂ ♂; 7 ♀ ♀).
Rama la (15,000 ft.), May 26; Litang (13,800 ft.), May 28.

Sub-family—LEPTOCIRCINÆ.

105. LEPTOCIRCUS CURIUS.

Papilio curius, Fabricius, Mant. Ms. ii, p. 9 (1787).
Leptocircus curius, Gray, Cat. Lep. Ins. Brit. Mus. *Papil*, p. 73 (185 Leech, Butt., China, Japan and Corea, p. 509 (1893).

Two specimens.
Panye (2,000 ft.), July 26; Tashianliang (1,500 ft.), July 31.

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* Smallest specimen from S. W. Thibet in Mus. Coll. is only 50 millim. Ty *P. acco* measures 62 millim.

106. LEPTOCIRCUS MEGES.

Papilio meges, Zinken-Sommer, Nov. Act. Accd. Nat. Cur. xv, 1831, p. 161, pl. 15, fig. 8.

Leptocircus meges, Moore, Lep. Ind. v., p. 136, pl. 417, figs. 2, 2 b, (1902) ; Bingham, Fauna, Brit. Ind., Butt. ii, p. 6, pl. xi, fig. 8 (1907).

Leptocircus virescens, Butler, Cat. Fab. Lep. B. M., p. 259 (1869) ; Moore, Lep. Ind. v, p. 136, pl. 417 (1902).

One specimen referable to *virescens*, Butler.

Pangam (2,800 ft.), July 29.

Sub-family—PAPILIONINÆ.

107. ORNITHOPTERA ACACUS.

Ornithoptera acacus, Felder, Wein. Ent. Mon. iv, p. 225 (1860).

Ornithoptera (Troides) acacus, Moore, Lep. Ind. v, p. 148, pl. 422, figs. 1, 1a, ♂, ♀ (1902).

One male specimen.

Salam Gam (3,000 ft.), July 29.

108. PAPILIO VARUNA.

Papilio varuna, White, Entom. i, p. 280 (1842).

Papilio astorion, Westward, Ann. & Mag. Nat. Hist., ix, p. 37 (1842).

Pomgerana astorion, Moore, Lep. Ind. v, p. 153, pl. 423, figs. 1, 1b (1902).

Papilio varuna astorion, Bingham, Fauna, Brit. Ind. ii, p. 25 (1907).

One male specimen.

Tila (3,100 ft.), July 23.

109. PAPILIO GANESA.

Papilio ganesa, Doubleday, Gray's Zool. Misc., p. 73 (1842).

Sabaria ganesa, Moore, Lep. Ind. vi, p. 56, pl. 487, figs. 1, 1a (1903).

Papilio polyctor ganesa, Bingham, Fauna, Brit. Ind., Butt. ii, p. 83 (1907)

Two male specimens similar to Assam examples.

Tulang (4,000 ft.), July 17 ; Kukfea (2,500 ft.), July 25.

110. PAPILIO MACHAON.

Papilio machaon, Linn, Syst. Nat. i, 2, p. 750 (1767) ; Leech, Butt., China, Japan and Corea, p. 516 (1893).

Several specimens, two of which (June 22 and 23) agree with Yatung example ; all others are similar to specimens from Western China.

Tizu (13,500 ft.), May 21 ; Tilang pass (14,000 ft.), May 28 ; Gera (9,000 ft.), June 7 ; Drowa Gompa (10,000 ft.), June 22 ; Sanga Chu Dzong (11,000 ft.), June 23 ; Chikung (8,500 ft.), July 3.

111. PAPILIO TAMERLANUS.

Papilio tamerlanus, Oberthür, Etud. d' Entom. ii, p. 13, pl. ii, fig 1, (1876) ; Leech, Butt., China, Japan and Corea, p. 521 (1893).

Several specimens.

Oroshi (10,000 ft.), May 22 ; Puda (14,000), June 30.

112. PAPILIO XUTHUS.

Papilio xuthus, Linn, Syst. Nat. i, 2, p. 751 (1767) ; Leech, Butt., China, Japan and Corea, p. 514 (1893).

Three specimens, all males.

One specimen agreeing with Western Chinese examples of the species.

Rima (6,500 ft.), May 7 ; Kahao (4,800 ft.), July 15 ; Giada (10,000 ft.), July 2.

113. PAPILIO XUTHULUS.

Papilio xuthulus, Bremer, Bull. Acad. Petr. iii, p. 463 (1861); Lep., Ost. Sib., p. 4, pl. i, fig. 2 (1864).

Papilio xuthus, Leech, Butt., China, p. 514.

One example of each sex, similar to specimens from Western China.

Batang (9,500 ft.), June 2.

114. PAPILIO SARPEDON.

Papilio sarpedon, Linn., Syst. Nat., i, 2, p. 747 (1767); Leech, Butt., China, Japan and Corea, p. 524 (1893).

One male specimen.

Tila (3,100), July 23.

115. PAPILIO BIANOR.

Papilio bianor, Cramer, Pap. Exot., ii, pl. ciii, fig. c, (1777); Leech, Butt., China, Japan and Corea, p. 527 (1893).

Papilio syfanius, Oberthür, Etud. d' Entom, xi, p. 13, pl. i, fig. 3 (1886) Leech, l. c. p. 532.

A male specimen referable to ab. *syfanius*, Oberth.

Nyachuka (15,000 ft.), May 23.

116. PAPILIO PARIS.

Papilio paris, Linn., Syst. Nat. i, 2, p. 745 (1767); Leech, Butt., China, Japan and Corea, p. 535 (1893).

One male specimen.

Pangam (2,500 ft.), July 24.

117. PAPILIO PHILOXENUS.

Papilio philoxenus, Gray, Zool. Misc. p. 32 (1831); Leech, Butt., China, Japan and Corea, p. 537 (1893).

Papilio dasarada, Moore, Cat. Lep. E. I. C. i, p. 96 (1857); Lep. Ind. v., p. 161, pl. 427, figs. 1, ♂ 1 a, b, ♀ (1902).

One male referable to the typical form of *philoxenus*, and one female of the *desarada* form.

Tsachung (7,000 ft.), July 4; Panye (2,000 ft.), July 26 (*dasarada*).

118. PAPILIO PLUTONIUS.

Papilio plutonius, Oberthür, Etud. d'Entom ii, p. 16, pl. iii, fig. 2 (1876). Leech, Butt., China, Japan and Corea, p. 541 (1893).

Two male specimens.

Gera (9,000 ft.), June 7.

119. PAPILIO CHIRON.

Papilio chiron, Wall, T. L. S. xxv, p. 66 (1865).

Zetides chiron, Moore, Lep. Ind. vi, p. 6, pl. 469, figs. 1, 1 c (1903).

One male specimen.

Dze River (15,000 ft.), August 1.

120. PAPILIO DEMETRIUS.

Papilio demetrius, Cramer, Pap. Exot, iv., p. 196, pl. 385, figs., E. F. (1782); Leech, Butt., China, Japan and Corea, p. 546 (1893).

Three male specimens.

Minzong (3,500 ft.), July 19; Muku (3,900 ft.), July 21; Sanpura (1,000 ft.), August 8.

121. Papilio helenus.

Papilio helenus, Linnæus, Syst. Nat. i, 2, p. 745 (1767); Leech, Butt., China, Japan and Corea, p. 548 (1893).

Two specimens.

Minzong (3,500 ft.), July 19; Khupa (2,500 ft.), July 25.

122. Papilio polytes.

Papilio polytes, Linn., Syst. Nat. i, 2, p. 746 (1767); Leech, Butt., China, Japan and Corea, p. 552 (1893).

Two specimens.

Cheng tu (Sze-chuen) (1,700 ft.), April 22.

123. Papilio alcinous.

Papilio alcinous, Klug, Neue Schmett, p. i, pl. i, figs., 1—4 (1836); Leech, Butt., China, Japan and Corea, p. 539 (1893).

One male specimen and two females.

Leng chu, Sze-chuen (4,500 ft.), May 7.

124. Papilio memnon.

Papilio memnon, Linn., Syst. Nat. i, 2, p. 747 (1767); Leech, Butt., China, Japan and Corea, p. 544 (1893).

One male specimen.

Chin-jih-ho (2,000 ft.), April 21.

(*To be continued.*)

SOME NOTES ON MAMMALS AND BIRDS IN SOUTH EASTERN TIBET.

BY

CAPT. F. M. BAILEY.

The following notes were made on a journey made last year from Ta Chien lu to Rima *via* Batang and Menkong on the Salween, with a diversion North-West to Shiuden Gompa. A good deal of the country had not been collected in before, so that, though only two new species were found the geographical distribution of others will, I think, be interesting. A collection of butterflies and moths was also made, and a paper on the former appears in this number of the journal.

MAMMALS.

Specimens of the following were collected and presented to the British Museum and have been identified by Mr. Oldfield Thomas :—

1. *Mustela siberica.*—One specimen obtained near Tachienlu at about 9,000 feet. Tibetan name—*Suri* or *Se Tong*; Chinese name—*Huang Shi.*

2. *Lepus kozlovi.*—This hare was found near Tachienlu at about 11,000 ft. and at many places on the road as far as Shiuden Gompa where it was very plentiful. Tibetan name—*Regong.* One shot near Shiuden Gompa on 27th June was about to give birth to six young.

3. *Myospalax baileyi.*—One specimen obtained at Rama-Song-Tu, 50 miles west of Tachienlu at 12,000 feet.

4. *Marmota robusta.*—Seen at several places between Tachienlu and Batang and also on the Jo la at altitudes from 14,000 to 16,000 feet. Eastern Tibetan name *Shu-A.* Central Tibetan *Chi-wi.*

5. *Ochotona roylei chinensis.*—New variety. One specimen obtained at Yara-Tsa-Ga 20 miles south of Tachienlu, at 13,000 feet. Eastern Tibetan name *Ara.* Central Tibetan name *Abra.*

6. *Ochotona tibetana.*—One specimen at Tasho, 30 miles east of Batang at 13,000 feet. Tibetan names *Abra* and *Ara.*

7. *Dremomys pernyi.*

8. *Sciurus castaneoventris michianus.*—Tibetan name for both these squirrels *Tong-Le* and *Ka-ji-ra.* Chinese name *Tiao-lin-tzu.* Squirrels were plentiful in the forests at altitudes of 10,000 to 13,000 feet.

In addition to the above small mammals, Takin and Goral were shot. One of the latter which was obtained at Ho-kou was of a greyish colour, while near Rima the Goral is a foxy red and skins of these animals are used for making coats. I also saw foxes and musk deer and traces of serow. Burhel are also found locally and I saw skins and horns in the villages. Bears and leopards were also said to occur but none were seen. A considerable trade in stag horns is carried on at Litang and Tachienlu. Mr. Elwes had asked me to look out for these and to bring back some horns if possible. The horns which I did buy I was obliged subsequently to throw away owing to transport difficulties.

I give the following notes obtained from natives for what they are worth :—

There are 3 varieties of stag whose horns are brought for sale to Tachienlu called in Tibetan (1) *Sha-na,* (2) *Sha-me* (3) *Sha-jia.*

(1) The *Sha-na* is said to be dark in colour and to have only 6 points to the horns. I saw horns of this stag which appeared to be those of a Sambur. Their stages are found 2 days march to the south of Litang.

(2) The *Sha-me* is reddish brown and has 12 points in the horns. It is found at a place called Yara-Tsurong-Kar, 2 days' march to the north-west of Tachienlu.

(3) The *Sha-jia* is grey with 12 to 16 points to the horns. It is found 3 days west of Tachienlu at La-li-shi.

BIRDS.

The following specimens of birds were also collected and have been identified by Mr. Ogilvie Grant:—

1. Hodgson's Eared Pheasant *(Crossoptilun tibetanum.)*—This very conspicuous and noisy pheasant was seen at many places between Tachienlu and the Tong la, the pass at the head of the Irrawady Valley. They move about in the thin forest near the tree level in flocks of from 6 to 10. They were nesting at 12,000 feet near Tachienlu in the middle of May but I did not succeed in finding a nest. Tibetan name near Tachienlu *Cha-kong.* Tibetan name further west *Cha-kai.* Chinese *Machi.*

2. Lady Amherst's Pheasant (*Thaumalea amherstiæ).*—These pheasants were plentiful on the Fei-yueh-ling, a pass three days south-east of Tachienlu and a few were seen at Tachienlu itself. They live at altitudes from 7 to 9,000. The cocks are noisy birds and will not fly. I did not see a single hen. Tibetan name *Ja.* Chinese name *Sen-chi.*

3. Himalayan Snow Cock (*Tetrogallus tibetanus*).—This bird was found on the passes west of Tachienlu above tree level. I did not see any west of Litang. Tibetan name *Kongmo.* Chinese name *Pe-mo-chi.*

4. Stone's Pheasant (*Phasianus elegans*).—I shot a specimen of this on the Fei-yueh-ling pass south-east of Tachienlu. It was plentiful at Tachienlu itself and a few were seen in suitable places up to Batang and again in the Yangtse Valley, two days' march south of Batang and near the Kia-La which is on the watershed between the Yangtse and the Mekong, but I did not see it west of the Yangtse Valley. Tibetan name *Tso-ka.*

5. Szechenyi's Pheasant-Grouse (*Tetraophasis szechenyi).*—A few were seen about 14,000 feet in the forests on the Ka-ji-la and Rama-la, two passes between Tachienlu and Litang. Tibetan name *Kwa-kwa-dzi.* Chinese name *Hua-we-tzu.*

6. Prjevalsky's Partridge *(Perdix sifanica).*— Found at heights of between 12,500 and 15,000 at suitable places from Litang to Dokong in the Upper Irrawaddy Valley. Eastern Tibetan name *Sakpa.* Central Tibetan name *Rhak-pa.*

7. Geoffroy's Blood Pheasant (*Ithagens geoffroyi.)*—Plentiful near Tachienlu between 11,000 and 13,000 feet. This bird lives in the highest forest and I have seen it in snow. It is very easy to approach and shoot but seldom flies. Tibetan name *Siri.* Chinese name *Sung-chi.*

8. Woodcock (*Scolopax rusticula*).—I shot one Woodcock near Tachienlu at 10,500 feet. Tibetan name *Chi-chia.*

9. White-bellied Pigeon (*Columba leuconota.)*

10. Lord Derby's Poroquet(*Palæornis derbyanus*) was found up to 12,000 feet from the Yangtse Valley south of Batang up to Sangachu Dzong at the head of the Lohit Valley, where this parrot was nesting in holes in trees at about 11,000 feet at the end of June. Tibetan name *Na-dzo.*

11. Common Cuckoo (*Cuculus canoris).*—One specimen shot at Tachienlu. Cuckoos were heard at many places along the road and on the Gara-la at 16,000 feet. I also heard them at Sangachu-Dzong. The Tibetan name is the same as the English.

12. Great Black Woodpecker *(Picus martius).*—Shot at Hsi Ngolo, 12,000 feet. Tibetan name *Nak-po Tung-ta.* Tibetans valued the flesh of this Woodpecker as medicine.

13. The Eastern Jackdaw (*Colæus neglectus*).—Sangachu-dzong, 13,000 feet. Tibetan name *Paya.*

14. Blyth's Willow Warbler (*Phylloscopus lugubris*).—Liang Ho Kao, 2 days south of Tachienlu, 13,500 feet.

15. Kamtschatka Willow Warbler (*Phylloscopus homeyeri*) —Poda, 14,200 feet, near Sangachu Dzong.

16. Rusty-breasted Blue Flycatcher (*Poliomyias hodgsoni*).—Ta Sho (near Batang) 13,000. feet. Tibetan name *Paon-Pali*.

17. Yellow-bellied Flycatcher (*Chelidorhynx hypoxantha*)—Michi (in Upper Lohit Valley, 12,000 feet).

18. Sooty Flycatcher (*Hemichelidon siberica*)—Sanga-chu-dzong, 11,000 ft.

19. Robin Accentor, (*Accentor rubeculoides*).—Gara La, 16,000 feet (west of Litang).

20. Eastern Alpine Accentor (*Accentor nipalensis*).—Tsema La, 15,600 feet (Irrawaddy-Salween watershed).

21. Black throated Accentor (*Accentor atrigularis*).—Pugo, 14,900 feet, between Sangachu-dzong and Shiuden Gompa. A nest on the ground in a tuft of dwarf rhododendron, containing 3 eggs on 27th June.

22. Blue-fronted Redstart (*Ruticilla frontalis*)—Tsema-La, 15,600 feet.

23. Daurian Redstart (*Ruticilla aurorea*).—Two nests containing 3 and 4 eggs were found. One was on the ground under a root at Kong Se Ka, 12,500 feet, on 8th June and the other in a hole in a wall at 11,000 feet between Yen ching and the Kia La, 11,000 feet, on 10th June.

24. Tibet Ruby-throat (*Erithacus tschebaiewi*).—Poda, 14,200 feet. Nest on ground in dwarf rhododendron with 3 eggs, 26th June.

25. Whitehead's Redstart (*Chimarrhornis bicolor*).—Hills, south-east of Rima, 10,000 feet; nest under stone with 4 eggs.

26. The large Laughing Thrush (*Ianthocincla maxima*).—Two specimens, one at Nenda, 13,500 (between Litang and Batang), and the other at Poda, near Sangachu Dzong at 13,500 feet. Tibetan name *Gya Tra*.

27. Elliot's Laughing Thrush (*Trochalopterum ellioti*).—Two specimens, one at Batang, 9,000 feet, and one at Lagyap in the Upper Irrawady Valley at 13,000 feet. Tibetan name *Gyamo*.

28. Hodgson's Grandala, (*Grandala cœlicolor*).—Boi-la-To pass, 13,500 feet, near Tachienlu.

29. Rock-Thrush (*Monticola cyanus*).—Fuchuang, 4,000 feet, east of Tachienlu

30. Gould's Thrush (*Turdus gouldi*).—Yulung Kung, 10,500 feet, one march from Tachienlu. Nest of twigs and moss lined with grass, situated in a bush 6 feet from the ground. The nest contained three eggs of a pale greenish ground colour with reddish brown markings. The eggs varied very little in size and averaged 2·95 c. m. × 2·01 c. m. Tibetan name *Chiama Gunka*.

31. Red-billed Liothrix (*Liothrix luteus*).—Tsa Chung, 7,000 feet, one march north of Ria.

32. Yunnan Nutcracker, (*Nucifraga yunnanensis*).—Below Sanga Chu Dzong, 11,000 feet, Tibetan name *Tong-she-sha-ga*.

33. Dabry's Yellow-backed Sun-bird (*Æthopyga dabryi*)—north of Ta-Hsiang-ling, 7,000 feet, 5 days east of Tachienlu.

34. Godlevski's Meadow Bunting (*Emberiza godlewski*).—Two specimens, one at Ta-Pen Ba, 5,000 feet, one day's march east of Tachienlu, and one at Batang, 9,000 feet.

35. Grey-backed Shrike (*Lanius tephronotus*).—Two nests found, one at Rama Song To, 11,000, 50 miles west of Tachienlu on 21st May and one at Bamutang, 13,000 feet, 8th June. There were four eggs each.

36. White-faced Wagtail (*Motacilla leucopsis*).—One nest at Nenda, 13,500 feet between Litang and Batang, on 31st May. The nest was in a hole in a wall and contained five eggs.

37. White-winged Grosbeak (*Nycerobas carneipes*).—Lagyap. 13,500 feet, Upper Irrawaddy Valley.

38. *Alauda cœlivox*.—Lagyap, 13,000 feet, Tibetan name *Chu-Te*.

39. Long-billed Calandra Lark (*Melanocorypha maxima*).—Gara La, 16,000 feet (near Litang).

40. Kozlowi's Babler (*Babax kozlowi*).—Shiuden Gompa, 13,500.

41. Indian Bush Chat (*Pratincola maura*).—A nest with five eggs on De-Ri-Ka-La, 14,000 feet, between Tachienlu and Litang on 27th May.

A THIRD LIST OF MOSSES FROM WESTERN INDIA.

BY

L. J. SEDGWICK, I.C.S.

Reference is invited to the first and second lists published in this Journal on 28th February 1910 and 20th May 1911 respectively. Since the latter date I have had hardly any opportunities for collecting, and the mosses mentioned below belong almost entirely to the collections, made by me in 1909 at Mahableshwar and Panchgani, in 1908-09 at Lonavla and in 1910-11 at Purandar Fort. Mr. Dixon has published two more articles in the Journal of Botany (for May 1911 and May (?) 1912) describing both mosses sent by Sal, and mosses sent by several other collectors from various parts of India. Two more new genera have been founded, one in the family of *Pottiaceæ*, to which the name *Hyophilopsis* has been assigned, and one in the *Entodontaceæ* which has been named *Bryosedgwickia*. The former, if maintained, will fall naturally between *Pottia* and *Hyophila*. The latter, belonging as it does to a family of pleurocarps which it is difficult to break up satisfactorily into genera, may or may not be accepted by other bryologists. Mr. Dixon differentiates it from *Pylasia*, to which genus he was at first inclined to refer the moss, on the ground of structural peculiarities of the endostome only. This moss appears to be very common on trees throughout the Western Ghats. *Hyophilopsis* on the other hand I have so far only found on the chunam of one house at Purandar Fort. In addition to these two new genera Mr. Dixon describes two new species of *Bryum* with one variety, and one new variety of an already known species of *Bryum*. *Bryum ghatense*, and *B. ghatense*, var. *Satarense*, both appear to be common mosses of the Ghats, as I have gathered the type at Mahableshwar, Lonavla, and Purandar, and the variety at the first and third of the places named. On Purandar they are especially common on dry banks and rock faces. The type and the variety frequently grow together. *Bryum Sahyadrense* also grows in similar situations on Purandar Fort, which appears to be a locality particularly suitable to this group of *Bryum*, called on account of the lax areolation of the cell-structure of the leaf *Areodictyon*. *Bryum pseudo-alpinum* var. *latifolium* also grows in damper places on earthy banks on the Fort, but is only found sterile.

New genera and species are marked with an asterisk. Unless otherwise stated all mosses mentioned below were collected by me.

Philonotis heterophylla, Mitt. Purandar, on earthy banks in shady places, st.

* *Hyophilopsis entosthodontacea*, Card. and Dix. gen. et. spec. nov. (Dixon in J. of B. for 1911, p. 137), on wall of a house, Purandar Fort, c.fr.

* *Bryum Sahyadrense*, Card. and Dix., sp. nov. (Dixon in J. of B. for 1911, p. 144), on rocks, Purandar Fort, c.fr.

* *Bryum ghatense*, Broth. and Dix., sp. nov. (Dixon in J. of B. loc. cit. p. 146), on stones of a wall, and on a stone pillar, Mahableshwar, on stone-work of a bridge, Lonavla, on earth banks, and on the face of a quarry, Purandar Fort, all c.fr.

* Var. *Satarense*, Broth. and Dix., var. nov. (Dixon loc. cit.), in the same localities, c.fr.

Bryum argenteum, var. *Australe*, Rehm. ms. in sched. (= *B. oranicum*, C. M. in Hedwigia, 1899, p. 68), Castle Rock, Western Ghats, October 1892, C. A. Gammie (in Herb. of Agricultural College, Poona), st.

* *Bryum pseudo-alpinum*, var. *latifolium*, Card. and Dix., var. nov. (Dixon in J. of B. for 1911, p. 149), Purandar Fort, on earthy banks, st.

Entodon Thomsoni (Mitt.) Jæg. on banks and rocks, Purandar Fort, c.fr.

Entodon plicatus, C. M., on trees, Lonavla, C. A. Gammie, 1903 (in Herb. of Agricultural College, Poona).

* *Bryosedgwickia Kirtikarii*, Card. and Dix., gen. et spec. nov. (Dixon in J. of B. for 1912, p. 154), on trees, Mahableshwar, Panchgani and Purandar and on stems of *Euphorbia*, Purandar.

In addition to the above I have to correct several names mentioned in the earlier lists.

Diaphanodon procumbens (C. M.), Ren. and Card., is the latest name for the moss mentioned in the first list as *Trachopodiopsis blanda*, Fleisch.

Neckeropsis Andamana (C. M.), Fleisch, for *Neckera Andamana*, C. M., in the first list.

Symphyodon (?) *angustus* (C. M.), Broth, for *Symphysodon angustatus* (C.M.), Jaeg., in the first list.

Orthomnium crispum, Wils., for *O. subcrispum*, C. M., in-ed. in the second list.

WOOD-DESTROYING WHITE ANTS OF THE BOMBAY PRESIDENCY.

BY

JOSEPH ASSMUTH, S.J.

With Plates I—V.

The following notes were first read, in a much condensed form, as a paper before the Bombay Natural History Society. They are now published, revised and enlarged, at the suggestion of Mr. H. V. R. Kemball, Secretary to Government, P. W. Dept., whom I cannot thank too much for the continued practical interest he has shown in my work. It was he who induced Government to order a large number of copies of this article for distribution among the officers of the P. W. D., to grant facilities for the further prosecution of my studies of the White Ants, who applied to the Railway Companies for co-operation, etc. I take this opportunity of tendering my sincerest thanks to the Agents of the G. I. P., B. B. & C. I., and M. & S. M. Railway Companies, who generously granted free passes for travels in connection with my investigations. My thanks are likewise due to my faithful assistant, Mr. J. P. Mullan, M.A., without whose help it would have scarcely been possible to obtain the many photographs illustrating this article, and whose services have been invaluable to me in many other ways. I am under special obligations to Professor Dr. Holmgren of Stockholm for his kindness in checking the determination of the Termites mentioned in this paper. Moreover, I have experienced kind assistance from many others, too numerous to mention ; to each and all of them I give my heartiest thanks.

As the title of this paper implies, wood-destroyers of the Bombay Presidency only are dealt with*—seven species in all. This number is most likely incomplete, but it is at present impossible to treat the subject exhaustively. The reason for this deficiency is not far to seek. Incredible as it may seem, it is nevertheless a fact that up to now deplorably little attention has been paid to the investigation of the Termite Fauna of India in general ; and as to the discussion of the wood-destroyers in particular, the following—as far as I am aware—is the first venture altogether. Consequently I have to rely almost exclusively on my own observations which have as yet been hardly extended beyond the borders of this province. They comprise the following areas : Bombay and Salsette Island ; Hubli and Bangalore in the south ; the Bhor Ghats (especially Khandala), Poona, Kirkee and the Ahmednagar Districts in the east ; lastly the Kaira District (Gujarat) in the north. Since large tracts of country are thus left out of consideration, this paper can only be regarded as a preliminary treatise on the wood-destroying Termites of the Bombay Presidency.

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* One of the species mentioned below, *Calotermes Assmuthi*, has so far been found only at Bangalore ; it is however very probable that it occurs also in the southern forests of this Presidency.

We start with a few introductory remarks intended for the benefit of those not yet familiar with the natural history of the Termites. "White Ants" have nothing to do with common ants as their popular name seems to imply. Their nearest relations in the insect world—so science tells us—are the Blattids, the best known representative of which is our common cockroach. (Real ants, on the contrary, are closely allied to wasps and bees, together with which they form the order Hymenoptera.) The scientific name of the White Ants is "Termites," and they form the natural order, Isoptera, which means "insects, having wings (*viz.*, fore as well as hind wings) of equal length."

In each fully developed colony of Termites, we always find a queen, *i.e.*, an egg-laying female, usually of much larger proportions than the other individuals of the colony, a king or male, and numerous workers and soldiers.* Workers as well as soldiers are "neuters," *i.e.*, their reproductive organs are not developed and consequently functionless. The workers, as their name implies, do all the work that is required for the maintenance of the colony, *viz.*, building the nest, procuring food, nursing the offspring, etc. The soldiers are responsible for the defence of the nest; for this reason they are, as a rule, provided with specially strong and pointed mandibles, a sort of small pincers protruding from the head. At certain seasons of the year (not all the year round) winged individuals, usually in large numbers, are found in the Termite nests; they are males and females. As soon as they have reached their full development, they fly out of the nest ("swarming" of Termites), then shed their wings, unite in pairs, and settle on some suitable spot to form a new colony of which they become king and queen respectively.

So much for the general introduction: we now proceed to discuss our special subject and first ask the question, "What about the wood-destroying propensities of White Ants? Do all Termites, indiscriminately, attack wood?" The wiseacres, specially such as have never thought it worth their while to look attentively at these "unsightly creatures," are at once ready with their answer. They put it tersely thus: "A White Ant is a White Ant," meaning thereby that all White Ants are alike or of the same species; consequently, if one is found to be fond of wood it goes without saying that all without exception are of the same disposition. Now nothing could be more remote from truth than such an opinion; a glance at plate I must convince everybody of this fact. This plate shows photographs of 10 soldiers, and certainly each of them is so different from all the others (except Nos. 2 and 3 which are closely related members of the same genus) that there can be no doubt but that they belong to really distinct kinds.* As it is wrong, then, to believe that all White Ants are alike, it is likewise wrong to suppose that all of them are injurious to wood. A good many of them, no doubt, are wood-eaters, but others are not.

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* Only one Indian species, *Anoplotermes cyclops* Wasm., is destitute of soldiers.

A close observation of facts shows that Termites may be divided into three classes: first those that make wood their staple diet in preference to anything else; second those that feed occasionally on wood and then only to a smaller extent; and third those that never touch wood at all. The first class are truly noxious insects, the second are more or less indifferent, and the third are altogether harmless (*i.e.*, as far as wood is concerned). To the first class belong *Leucotermes indicola* Wasm., the genuine Indian "house termite" (see plate I, fig. 1), *Coptotermes Heimi* Wasm. (pl. I, 2), *Coptotermes parvulus* Holmgr. (pl. I, 3), and *Odontotermes Feæ* Wasm. (pl. I, 4). These four are the most important wood-destroyers; Termites occurring in houses or dry timber of any sort will in a large majority of cases be found to belong to one of these kinds. But they are not our only noxious species, three others have to be added which, however, are of decidedly rarer occurrence; they are not, as a rule, present in houses but only in beams, logs and the like in the open: *Calotermes (Neotermes) Assmuthi* Holmgr. (pl. I, 5) *Microtermes anandi* Holmgr. with the distinct forma *curvignathus* (pl. I, 6), which is usually met with in the central parts of the Presidency, and *Microcerotermes Heimi* Wasm. (pl. I, 7).

The second class—occasional wood-eaters—is rather large and comprises a great many different species. Especially noteworthy among them are the mound-builders, *i.e.*, all those Termites that build overground structures above their nests. The real nest is, as a rule, situated in holes excavated underground, the mounds are merely an accumulation of earthy material brought up from below when enlarging the nest quarters. All our mound-builders are "fungus growers," that is to say, they prepare within their nest-holes a kind of porous structure looking somewhat like a honey-comb or sponge, on which they grow the chief item of their diet, a certain fungus. Consequently they venture but rarely out of their nests in search of other food, and this apparently only when about to ameliorate the old, or construct fresh, fungus beds. For this purpose they are commonly satisfied with small fragments of wood (dry branches and the like) and dry leaves or grass lying

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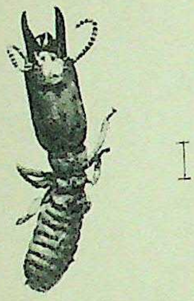
* There are, of course, many more different species of White Ants to be found in India; but the ten photos represent Termites either more nearly concerned with the subject in question or of more common occurrence in the Bombay Presidency.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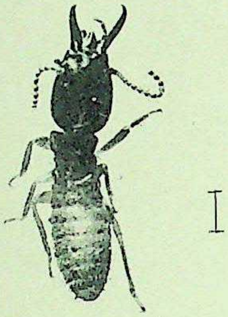
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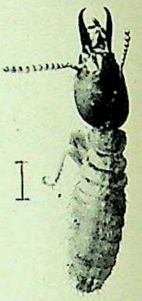
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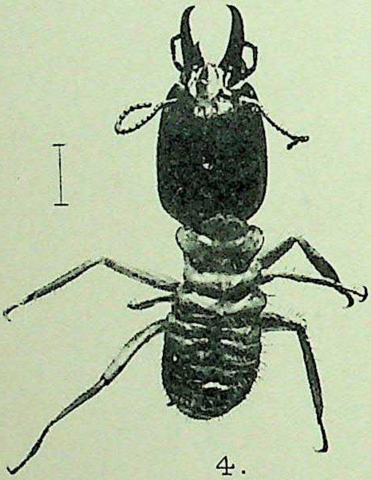
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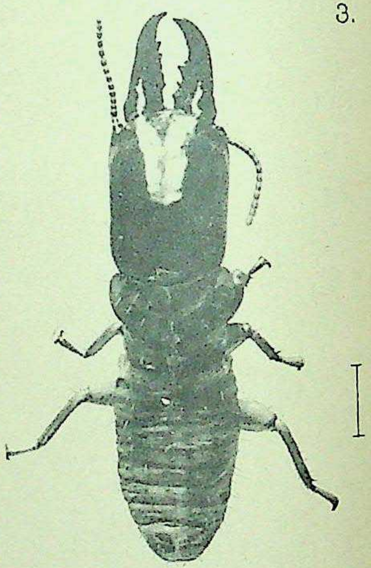
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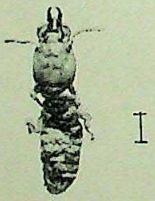
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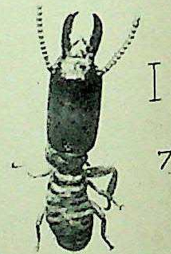
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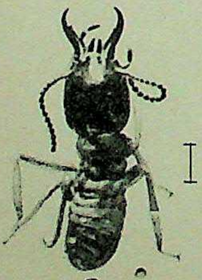
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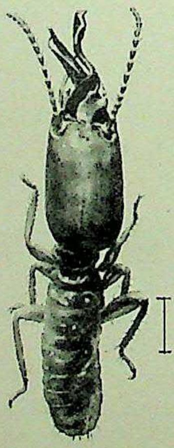
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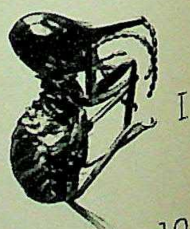
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EXPLANATION OF PLATE 1.

AND

SHORT DESCRIPTIVE NOTES OF THE WOOD-DESTROYING SPECIES.

(All photos taken with Zeiss' Combined Horizontal and Vertical Camera, and Micro-Planar 75 mm.)

FIG. 1.—*Leucotermes indicola.* (Indian White Termite.)—Head elongate, parallel-sided, cylindrical; yellow, bronzed in front; scantily covered with hair.—Mandibles brown, strongly built, slightly curved; left mandible with a few rudimentary teeth at base.—Antennæ (feelers) of 15 joints.—Body whitish, rather densely hairy.

FIG. 2.—*Coptotermes Heimi.* (Heim's Cutting Termite.)

FIG. 3.—*Coptotermes parvulus.* (Small Cutting Termite.)—Both species very much alike, the latter a trifle smaller than the former.—Head oval, arched, narrowed in front, much longer than broad.—Forehead with comparatively large circular opening on slightly raised tubular prominence, midway between feelers.—Mandibles brown, curved inwards and slightly upwards; left mandible little indented at base.—Antennæ of 13-14 joints. (*N.B.*—The left antenna of No. 2 is broken off and lies, in inverted position, just behind its basal joint.)

FIG. 4.—*Odontotermes Feæ.* (Fea's Toothed Termite.)—The biggest of our *Odontotermes*—species.—Head somewhat rectangular, rounded, slightly narrowed in front.—Mandibles strong; left with a prominent sharp tooth near middle.—Antennæ of 17 joints.—Abdomen rather densely covered with strong setæ (stiff hair).

FIG. 5.—*Calotermes* (*Neotermes*) *Assmuthi.* (Assmuth's Fair [Fresh] Termite.)—Head big, arched, somewhat flattened towards front, nearly parallel-sided.—Mandibles strongly built, both of them with several strong, rather blunt teeth; right mandible somewhat more curved than left.—Antennæ of 15 (-16) joints.

FIG. 6.—*Microtermes anandi* f. *curvignathus.* (Small Termite of Anand, form "with curved mandibles.")—The smallest of our wood-destroyers.—Head yellow, oval, distinctly narrowed in front; scantily covered with fine hair.—Mandibles slender, in the main straight, but the long tip bent strongly inwards; outer half dark-brown.—Antennæ of 14 joints, gradually thickening towards the tip.

FIG. 7.—*Microcerotermes Heimi.* (Heim's Small-horned Termite.)—Head yellow, slightly brown in front; rectangular, much longer than broad, truncated anteriorly; with two tiny protuberances (horns) near base of feelers.—Mandibles dark-brown, slightly curved, inner margin distinctly but irregularly serrate.—Antennæ of 13 joints, pale yellow.

FIG. 8.—*Odontotermes obesus.* (The Fat Toothed Termite.)—Mound-builder.

FIG. 9.—*Capritermes incola.* (The Inquiline Goat-Termite.)—"Inquiline," because it is usually found associated with other Termites; "Goat-Termite," because of its twisted mandibles.

FIG. 10.—*Eutermes biformis.* (The Double-formed Fine Termite.)—"Double-formed," because of the two forms of soldiers—bigger and smaller—found in each colony.

round about the mound. Since, therefore, the Termites forming the second class are of little consequence as wood-destroyers, only one species is given as a representative of them, *viz.*, *Odontotermes obesus* Ramb. (pl. I, 8) which is the common mound builder in the Bhor Ghats, Salsette Island, etc.

The third class—harmless Termites—is by no means small and insignificant, as many will be inclined to believe; the species it is composed of are, in fact, fairly numerous. Some of the kinds included in this class are well characterised and easily recognisable by the peculiar build of their soldiers, *v. g.*, *Eutermes biformis* Wasm. (pl. I, 10) where no biting mandibles are developed, but instead of them a nose-like outgrowth from the head, through which a sticky secretion is discharged as a means of defence, and *Capritermes incola* Wasm. (pl. I, 9), where the mandibles are curiously twisted and unfit for inflicting any bite. Other kinds belong to what may in a certain sense be called "parasitic Termites," for they build no separate nests of their own, but, as a rule, take up their abode in the nest quarters of the mound builders, like *Synhamitermes quadriceps* Wasm., and others.

Now the question arises, how are we to know one species of White Ants from the other? That some such knowledge is extremely useful for the practical engineer, the architect, etc.—so as at least to enable them to tell a noxious from an indifferent or harmless kind—need hardly be emphasised. But for the man who is going to try experiments whether such and such a kind of wood, either in its natural state or treated with certain preservatives (creosote, carbolineum, or the like), is termite-proof or not, it is not only useful but altogether indispensable. This is evident to anyone who reads the sometimes rather voluminous reports on these matters. Or, what can be the decisive value of experiments of which but the following scanty information is given: "pieces of different kinds of wood buried in the nests of White Ants" or "placed in ant-hills," and "found intact when dug up after three months," etc.? The principal point is completely left out of consideration, *viz.*, which were the Termites made use of for this trial? If the experimenter put his pieces of wood in nests of the third class of Termites mentioned above, it was not at all remarkable that he found them safe after the three months or so they had been in the nests; even if he had left them there for double the time and more the Termites would not have cared for them. But let the timber be exposed to the attacks of the species of the first class, and the result will probably be altogether different from what it has been.

Even experiments carried on with species of the second class, the mound-builders (and this is apparently the usual course taken, though no scientific name of a single species is mentioned in any of the reports), are bound to be misleading. Logs of wood buried in, or driven into, mounds will, I believe, in the majority of cases, be attacked only when the pieces obstruct nest holes or passages built by the White Ants; for it is quite natural that the Termites should try to remove the obstacle by destroying the wood. If, however, the wood put into the mound does not block any passage, it is quite probable that the White Ants will not go out of their way to feed on it. Real test experiments can only be brought about by giving the wood to genuine wood-destroyers (Termites mentioned under class I); if they leave it alone after sufficient trial, it may be said to be "termite-proof," but not otherwise.

What has been said so far seems sufficient to make good our previous statement that some knowledge of the specific differences of White Ants is required from all who by their professional work are brought in contact with them. But how far is this knowledge to extend? Ought everyone to be able to find out the scientifically correct name of any given specimen? This seems clearly to be asking too much, since even the experienced specialist often finds this by no means an easy task. Opinions on this point may, of course, be divided, but to my mind it is quite sufficient for the practical purposes of the architect or engineer, if he is able to tell the really noxious Termites from the others.

To accomplish this minimum, a careful study of the photographs on plate I and their detailed comparison with actual specimens is all, I believe, that is required; the photos alone will, it is hoped, prove more serviceable to the practical man than lengthy scientific descriptions or elaborate determinative tables. All our wood-destroyers, as far as at present known to the writer of this paper, are represented on plate I, * magnified to the same scale, *viz.*, about ten times their natural size (the latter is indicated by the hair-line accompanying each figure). Their chief distinctive marks—peculiar build of head and mandibles, and natural size—come out with sufficient clearness, so that with a judicious application of a common pocket lens (not to mention a good amount of patience and perseverance, so indispensable for this rather trying work) everyone ought to be able to say, with a fair degree of certainty, whether a specimen examined by him belongs to the kinds injurious to wood, or otherwise. Since the mound-builders and several other equally easily recognisable forms need not be taken any special notice of—their tendencies for destroying wood, as has been pointed out, not being of any great importance,—only seven species remain for exact identification. This task ought not to appear so difficult as to discourage one from trying to master it.

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* Photographs of soldiers only are given because they alone have such conspicuous peculiarities of form as to mark off sufficiently well one species from the other. The workers of the various kinds look all more or less alike save that they differ in size.

It will be rendered yet a good deal more easy if attention is paid to some noteworthy facts—chiefly of a biological nature—which I propose to discuss in the following pages. In doing so I limit myself in the main to the more important noxious forms *Leucotermes*, *Coptotermes* and *Odontotermes* (*Feæ*).

In the first place I mention a feature which is not just very striking, but yet must not be passed over in silence, as it is, in a higher or lesser degree, found in all true wood-destroyers—*Odontotermes Feæ* alone excepted—*viz.*, the opaque white appearance of the body or abdomen of soldiers as well as workers. The whitish colouring of the latter is specially noteworthy: for the workers of almost all non-wood destroying species have their abdomen coloured distinctly dark and blackish, owing to the earthy material contained in the intestinal canal.

As regards *Coptotermes*, it is to be noted that the colour of the head is a very pronounced brown red, which is much deeper than in any other kind of Termites. Still more characteristic of this form is the large amount of milky white fluid which the soldiers give off from their mouth when irritated (*v. g.* when squeezed with a pincette, or disturbed in any other way). When the soldiers are put in alcohol, this fluid rapidly coagulates and forms a little white ball of the size of a pin-head or so, fixed between the mandibles. No other termite shows this phenomenon in like manner.

It may here be added that the soldiers of *Microtermes*—the most conspicuous feature of which is their small size—are likewise distinguished by their giving off a relatively large drop of secretion. But in their case the fluid is transparent, and when placed in alcohol, turns into a sticky, semi-transparent, jelly-like mass to which everything rather firmly adheres which comes in contact with it.

When Termites are found actually feeding on wood, the task of identification is considerably lightened by a close study of the peculiar way in which each species attacks wood. It is a well-known fact that the bark-boring beetles (*Scolytidæ* and others), and specially their larvas, mine the bark in such a manner that the ensuing figure is quite characteristic of the species by which it has been made. Thus by examining the said figures an expert will be able to ascertain the name of the particular species to which they are due. Now I believe that something quite similar is to be observed with regard to our wood-eating White Ants. They also produce what I propose to call "feeding-figures" (from the German "Frassbild") characteristic of the several noxious species. Plates II, III, and IV give photographic representations of the different feeding-figures. I add detailed descriptions of those of our chief wood-destroyers.

Leucotermes indicola always attacks first—and in many cases (especially as regards dealwood) exclusively—the soft portions of wood, leaving intact the harder parts, *i. e.*, the annual rings and knots. Thus a very striking feeding-figure results which is shown in the first photo of plate II. There we see the annual rings stand out as well marked parallel lines, each two adjacent ones being separated by a deep groove. In such kinds of wood, where the annual rings are not so well developed as in dealwood, the feeding figure is, of course, not quite so striking, yet it is in all cases constructed on the same lines.

Where *Leucotermes* meets small empty spaces such as in little boxes, it fills them up in a peculiar way. Broad patches of a rather thin greyish material—consisting apparently for the greater part of the excrements of the Termites—are arranged in more or less horizontal layers one above the other, with vertical partitions between them, so as to form a number of irregularly built chambers of different sizes. The chambers are connected by a good many smaller or bigger holes to enable the Termites to pass from one into the other. The general appearance of such a structure is made evident by the second photo of plate II which shows a small dealwood box attacked by *Leucotermes*. The inner space of the box (lower portion of photo) gives a picture of the just described "fillings" of *Leucotermes*, while the lid (upper portion of photo) exhibits the abovementioned lines of the annual rings with grooves between them.

Similar fillings—commonly on a smaller scale but after the same pattern as detailed above—are constructed by *Leucotermes* in any sufficiently large hole forming in the wood as a result of prolonged feeding in a limited area. We are sure to find them in such places where the annual rings are close together and, at the same time, their hard portions greatly reduced, as is the case with timber cut from near the bark of a tree. In wood of this sort the Termites devour everything between the upper and lower surface of the board, plank or the like, leaving only two sheets—sometimes as thin as card-board—above and below; in the empty space between they build their peculiar fillings.

Something akin to these structures we find also on nearly every piece of wood on which *Leucotermes* have been allowed to feed undisturbed for a long while, even if larger holes as mentioned above are missing. The fillings are then constructed on quite a simple plan showing only the ground—or predominant form of the more elaborate pattern, *viz.*, a ribbon or sheet-like structure. They are easily recognised on the first photo of plate II as a sort of small ridges or broader patches built across the deep grooves cut into the wood.

Coptotermes—as appears from the deal-board represented in the first photograph of plate III—has a feeding figure similar to that of

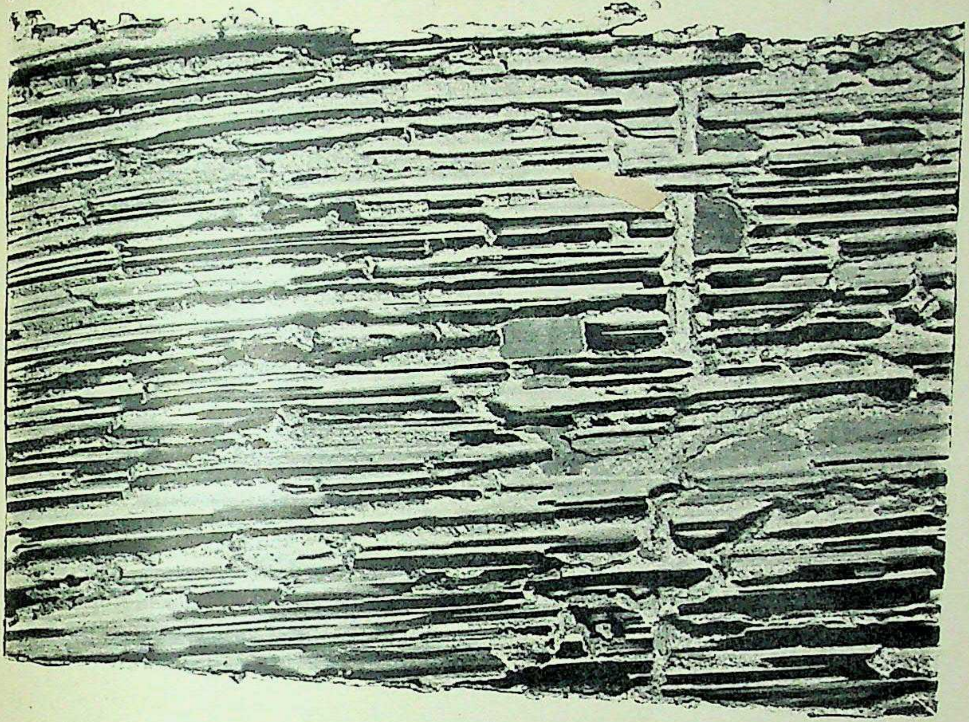

Fig. 1. Board of deal-wood attacked by *Leucotermes.*

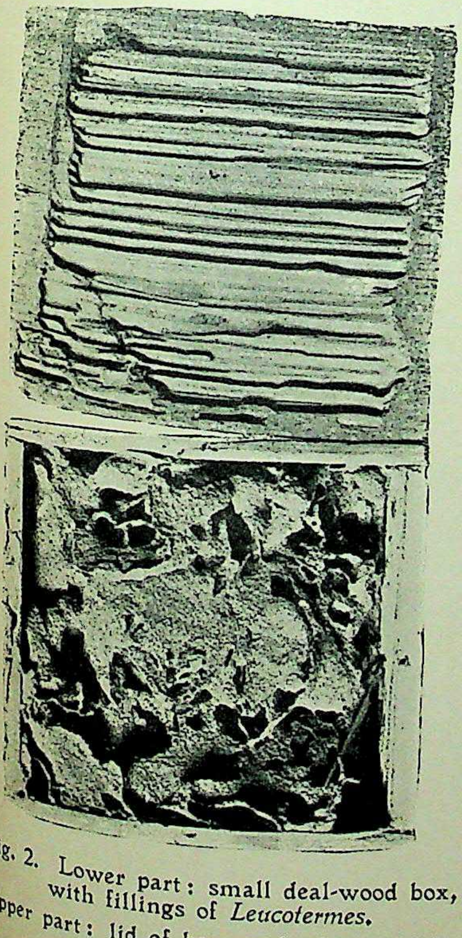

Fig. 2. Lower part: small deal-wood box, with fillings of *Leucotermes.*
Upper part: lid of box partly destroyed by *Leucotermes.*

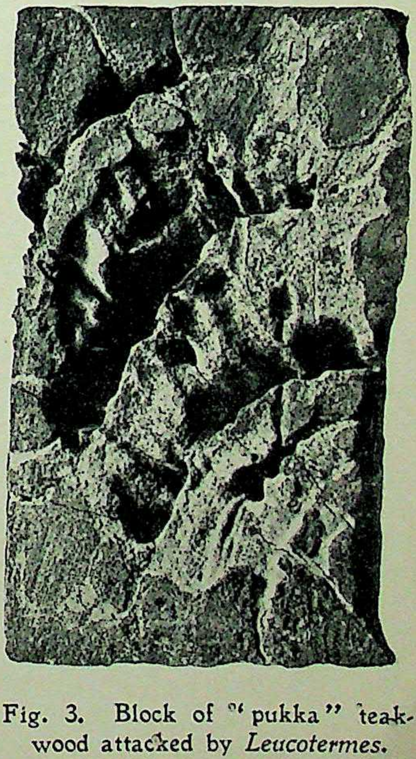

Fig. 3. Block of "pukka" teak-wood attacked by *Leucotermes.*

Leucotermes. But there is this difference that the soft woody tissue is not completely destroyed; larger or smaller bits of it have been left intact together with long strands of harder tissue ("the late summer-wood" of the annual rings). These strands do not, therefore, stand out like parallel clear-cut lines which are so conspicuous a feature in the feeding figure of *Leucotermes*; but their appearance is more like that of strips of varying breadth placed irregularly side by side. The Termites make not unfrequently cross-cuts even through the hard tissue of the annual rings; this is marked on our photo by the short transverse lines by which neighbouring grooves (represented by the long black lines) communicate with each other.

The fillings of *Coptotermes* are altogether different from those of *Leucotermes*, and quite characteristic of this kind. They are not made up of broad thin ribbons or sheets as described above, but of a wire or string-like material intertwined in such a way as to form a sort of irregular network. Sometimes the "strings" of the network appear rather flattened and coarse as in the upper part of the left half of the first photograph of plate III, sometimes their shape is more slender and roundish as in the lower portion of the photo. The fillings of *Coptotermes* are a good deal tougher and not so easily breakable as those of *Leucotermes*.

Yet another curious habit of *Coptotermes* must here be mentioned. Wherever these Termites come across very smooth surfaces they cover them with their excrements, probably to facilitate the passage over them; they often do the same also on the inner walls of the holes and tunnels they have eaten into the wood. The first photograph on plate IV shows a wine bottle* taken from a nailed-up box into which the Termites had found their way. The coating of excrements on the surface of the glass comes out quite distinctly; it forms, as usual, an unequally spread cover: in some places it appears rather thick, in others it is scanty or altogether wanting. *Leucotermes* makes a similar coating on smooth surfaces, but it is somewhat more fine-grained and lacks the numerous whitish dots so clearly visible all over the layers deposited by *Coptotermes* (unfortunately not appearing on our photo).

With regard to the last of our common wood-destroyers, there is one peculiar feature to be noted which marks them off at once and quite unmistakably from the two kinds already mentioned: *Odontotermes Feæ* invariably destroys wood from the surface inwards, whereas *Leucotermes* as well as *Coptotermes* attack the inner tissues leaving the outer layer almost entirely intact. The latter forms are consequently not so easily noticed when feeding in wood, while the presence of the former can at once be detected. This is rendered all the more easy for the following reason. Nearly all Termites—except the grass-feeders, like *Eutermes*, etc.—avoid light and air as much as possible. Now *Odontotermes Feæ* feeding on the surface of a board or so, would necessarily be exposed to these two from the termite-standpoint undesirable elements ; so to guard against them the White Ants build a cover of mud taken from the surrounding ground over the space chosen for the attack, and then start eating the wood underneath the shelter. These coatings of mud—which are either red or black or greyish according to the colour of the soil—form at times patches of considerable extent over the surface of the wood, and cannot be possibly overlooked by any tolerably attentive observer.

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* My grateful acknowledgments for this valuable present are due to Mr. R. A. Spence of Messrs. Phipson & Co.—I call special attention to a very remarkable fact clearly appearing on the photo : even the tinfoil capsule of the bottle has in some places been destroyed by *Coptotermes* which is, perhaps, the most formidable of our wood-destroyers.

It should be noted that both *Leucotermes* and *Coptotermes* construct covered passages as well when for some reason or other they are forced to appear on the surface, *v.g.*, when trying to get at wood some distance away from their underground nests. But these passages have always the appearance of lines, never of broad sheets as with *Odontotermes Feæ*. They are just large enough to allow the Termites to pass each other when meeting in the tunnel. Moreover, these passages are constructed of the same material as the fillings, that is to say, they consist for the most part of excrements of Termites; in no case are they made of earthy material taken from the ground near by. The tunnels of *Coptotermes* are slightly larger and their building material looks somewhat more coarse, than with *Leucotermes*.

The feeding figure of *Odontotermes Feæ* is represented in the second and third photographs of plate IV. Its characteristics are that the wood of the whole area on which the Termites have been feeding, is destroyed from the surface inwards, not even the hard portions of the annual rings being left intact. It is, moreover, a striking fact that usually not the entire surface is attacked by *Odontotermes Feæ*, but only certain portions of it (*cp.* especially the last photo). Thus the wood presents the view of an irregular arrangement of holes—some deep, some shallow—interspersed with narrower or broader patches of untouched wood.

In the second photo we see parts of three deal-wood staves taken from a cement-barrel. The middle piece is an instance of a rather exceptional case: the entire surface of the wood has been attacked and eaten up to various depths. The other two pieces show what commonly happens: in some places the surface area has been left intact (the dark patches appearing in the picture), in others it has been destroyed together with portions of the wood-tissue underneath (light patches of picture).

On the third and last photo a big branch cut down from a live

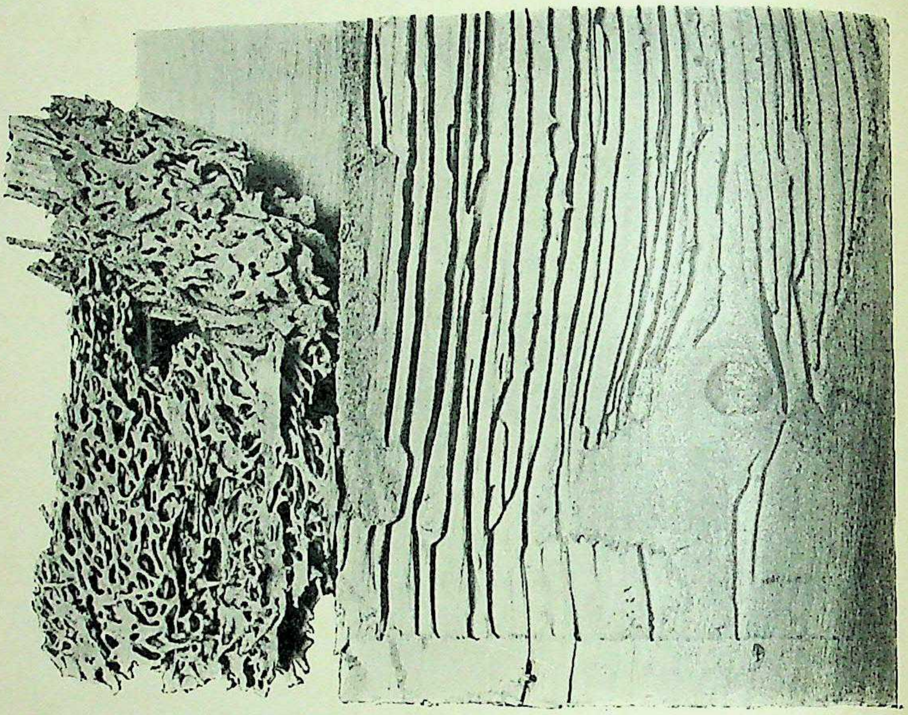

Fig. 1. Deal-wood attacked by *Coptotermes*. To the left: fillings of *Coptotermes*.

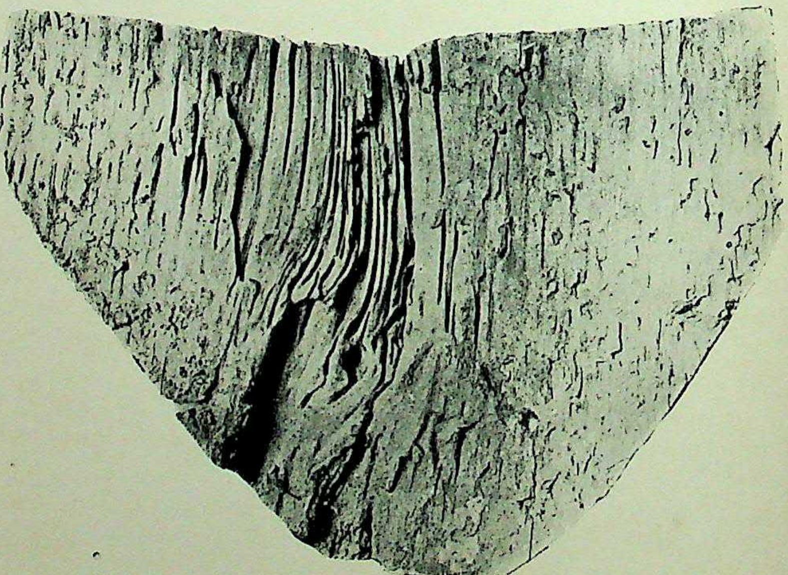

Fig. 2. Block of yarra-wood attacked by *Coptotermes*.

fig-tree (*Ficus religiosa*) is represented[*]. The heart-wood of the branch has not been touched by the Termites, but otherwise a good many holes varying in depth have been made from the bark inwards.

The fillings of *Odontotermes Feæ* are quite distinctive of this species. They invariably consist of coarse earthy material—red, black, or grey, as the case may be—taken from the surrounding ground. The Termites are in the habit of stuffing with this material any cavities in the wood, no matter whether already existent as v.g., in hollow bamboo-poles, or made by the Termites themselves. Small tunnels traverse the frequently large masses of mud piled up in the holes; here and there widened chambers are constructed where usually a great many Termites may be found together. The inner surface of the tunnels as well as the chambers is rather rough, hardly any polishing being noticeable. The mud seems scarcely to be impregnated with special secretions to make it hard as most of our mound-builders are wont to do with the building material of their nests; consequently the fillings of *Odontotermes Feæ* are easily broken especially when they are dry.

Beside the characteristic feeding figures and fillings, there is another very noteworthy means to find out the three just mentioned kinds of wood-destroyers, *viz.*, their particular time of swarming. As has been said before, numbers of freshly reared winged forms (males and females) leave the nests at certain seasons of the year. These swarming periods are the same every year, and more or less different for the different species—or, at least, genera—of White Ants. Now with regard to our common wood-eaters, I have been able to ascertain the following through observations extending over a couple of years: *Leucotermes* swarm in the morning (8 o'clock and later) during the first showers of the monsoon; *Coptotermes* leave the nest towards sunset at various times during the dry season, specially in January, February and March; *Odontotermes* take wing before nightfall shortly after the close of the rainy season, usually in the last third of September. So, when we see winged Termites coming out of an underground nest at the said periods, we may be sure that they are either *Leucotermes*, or *Coptotermes*, or *Odontotermes*, as the case may be.

Concerning the other less frequent, and therefore less important, kinds of wood-destroying Termites, I regret to be for the present unable to give reliable details about their feeding figures and fillings; the investigations I have so far been able to make are not sufficiently numerous to allow of general conclusions. However I doubt not that also with regard to these kinds similar characteristic features will be brought to light by further studies. For the time being we must be satisfied with the facts furnished in the preceding lines, *i.e.*, that our common noxious wood-eaters construct, and may be known by, their quite distinct feeding figures as well as fillings.

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[*] I have to thank Mr. J. W. MacKison, Executive Engineer to the Bombay Municipality, for this fine specimen now in the Biological Museum of St. Xavier's College.—None of our wood-eaters destroy live trees, but only dry portions of them.

I add some few remarks about the localities in which wood-destroyers are known to exist. *Leucotermes* is frequently met with in houses in Bombay; I have also found it occasionally as an inquiline in nests of mound-building Termites in Salsette (in the jungle along the Tulsi river, east of Borivli village, about 20 miles north of Bombay), and Khandala (Bhor Ghats). *Coptotermes* abounds in houses and all sorts of timber in Bombay; I have also taken specimens from logs of firewood in Gujarat (Anand and Vadtal, Kaira District); another lot was sent to me from Karachi.* *Odontotermes Feæ* is of common occurrence in all kinds of dry wood in Bombay, Borivli Jungle, Khandala and Poona. Once I observed them feeding on railway sleepers piled up at Karjat Station (G.I.P.R.). *Calotermes* was found in a big branch of a dry tree at Bangalore; *Microtermes* in dry wood (board, logs, and the like) at Valan (Ahmednagar District), Anand, Bombay and Khandala (in the latter place as an inquiline in mounds of other species); *Microcerotermes* in dry bamboo stumps in Borivli jungle, in a pole stuck into the ground at Poona, in logs of firewood at Vadtal, and at Valan. Other habitats of the different kinds of wood-destroyers will no doubt be added in course of time if more general attention is paid to these matters.

It is as yet impossible to give an answer to the burning question, "Which woods are undoubtedly termite-proof?" Teakwood is often mentioned as such, and more recently the Australian Jarra-wood is time and again praised for possessing this quality. That such assertions are not altogether in harmony with facts is evident from the third photograph on plate II showing a piece of "pucka" teakwood attacked by *Leucotermes*, and the second photo on plate III representing a block of Jarra-wood partly destroyed by *Coptotermes*.† Experiments so far made to ascertain which different kinds of wood—treated as well as untreated—are safe from the attacks of White Ants, are in my opinion largely unreliable, because it has been left out of consideration whether the Termites made use of for these trials were genuine wood-destroyers, or not. Further investigations are, therefore, necessary, if the question is to be settled definitely.

Before concluding this paper, I beg to add a few remarks on an all-important desideratum in relation to widening our knowledge of the various noxious White Ants. This desideratum is:

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* My sincere thanks are due to Mr. Kundanmal Utamsing, S. D. O., who was kind enough to collect these specimens for me in a house badly infested with them.

† A present to my collection from Mr. L. H. Savile, Executive Engineer to the Bombay Port Trust, to whom I am greatly indebted.

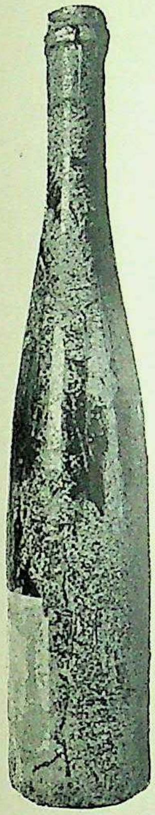

Fig. 1. Wine-bottle covered with excrements of *Coptotermes*.

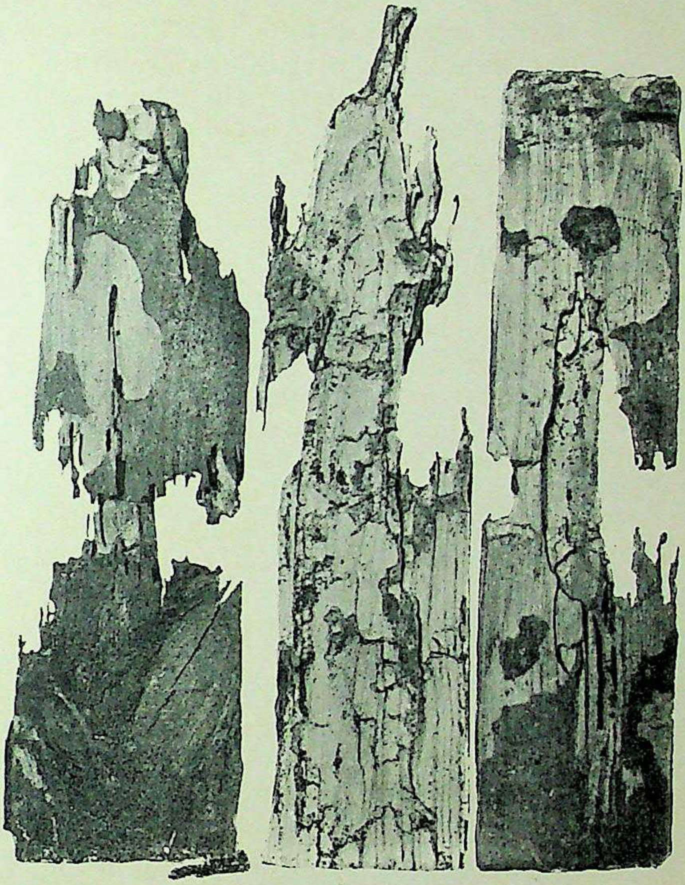

Fig. 2. Staves of deal-wood destroyed by *Odontotermes*.

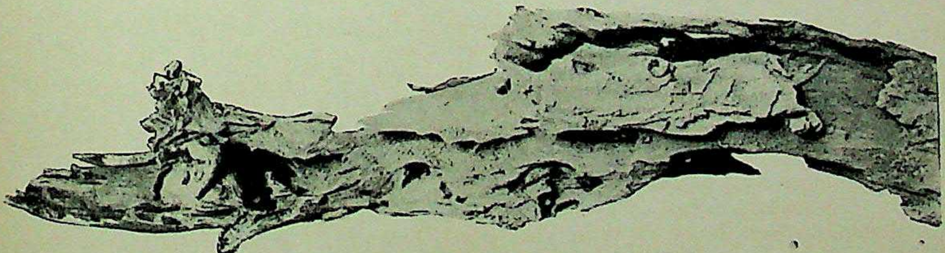

Fig. 3. Dry branch of live banyan tree attacked by *Odontotermes*.

co-operation. What we know so far of Indian Termites in general, and of the wood-destroying forms in particular, is deplorably little, and this, in spite of the fact that the ravages of White Ants are so well known to every resident in the country, and that nearly everyone has had, and has still, to complain of them. All wish, of course, to get rid of the pest, but nobody appears to be prepared to take his share in the necessary investigations into the subject. And yet, if we want to succeed in protecting ourselves from the damage caused by White Ants, our first and foremost endeavour must be to study them, so that we may know as much as possible of their various habits. To try to fight the Termites without this indispensable information is just as useless as to attempt combating a disease without knowing anything of its nature and specific symptoms.

But what of the many "Termiticides" now offered for sale as so many "infallible means to utterly exterminate all White Ants?" If a single one of them would fulfill what is claimed for it, further studies of the Termites would, of course, seem superfluous from the practical or economic point of view. But this is, unfortunately, not the case; all Termiticides have so far been found unavailing when put to the test. The reason why is clear. At present we know only how to get at single Termites found outside their nests; we are altogether ignorant of the Biology of the White Ants, *i.e.*, of their mode of life, the structure and position of their nests,* the dwelling-place of their queen. Yet with all this—and especially the last—we must be well acquainted before we can destroy Termites effectually. As long as a reproductive female (a queen) remains in the nest, the colony will survive, because the loss of some workers or soldiers will soon be made good by the fertile female.

This, then, is our task for the future: to find out which species are true wood-destroyers, and study their Biology. But even the most strenuous efforts of one man—or a few—are altogether insufficient to solve this problem for so vast a country as India. The generous co-operation of all who are interested in the war to be waged on the White Ants, especially of the Officers of the Public Works Department, Railway Engineers, etc., is an imperative necessity. If everyone would make a point of helping to the best of his power in clearing away the darkness still prevailing regarding our knowledge of the noxious Termites, great things could, no doubt, be achieved within a short time.

And what is required of the co-operator in this great plan is, after all, but little: whenever and wherever you come across White Ants in wood or near it, drop as many as you can get hold of—

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* All our wood-destroyers seem to have their nests underground, not in the wood attacked by them.

especially soldiers—in a tube [or [small bottle filled with common methylated spirit (such as used for burning purposes); write locality, date and any other remark you have to make, with lead-pencil (not with ink) on a slip of paper and place it into the tube; secure, if possible, a bit of the wood attacked; pack both—tube and wood—securely in a box, and send it to the writer of this paper (Rev. Joseph Assmuth, Professor of Biology, St Xavier's College, Bombay [Fort]).* That is all you are requested to do. If advisable I am perpared to go personally to places badly infested with Termites to make investigations on the spot.

Thus—by the active co-operation of all concerned—it will be possible to gain, in course of time, a clear insight into what must be our first and foremost endeavour to know about the White Ants: which species are genuine wood-destroyers, which districts are free from and which are infested with them, which is their mode of living, nesting, breeding, etc. Then, and not till then, the further and final step may, with a fair chance of success, be taken: the finding of suitable means to combat the White Ants.

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* My friend, Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Agricultural Research Institute, Pusa, Bengal, is also ready to receive specimens and answer inquiries.

PROGRESS OF THE MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

Since the last report of the progress of the Survey was made, some very interesting collections have been received. From the north Mr. Crump has sent in an interesting collection from Kathiawar including several specimens not before obtained by the Survey. He is now at Danta in Mahi Kantha, having worked up through Palanpur to Mount Abu. It is proposed now to shift him right away to Kumaon from which district a number of new species were described by the older authors.

When writing in the last Journal we mentioned that Mr. Shortridge was busy in Coorg and from there we received, just before the Journal was published, one of the finest collections so far received and numbering some 800 specimens. The collection contained a number of Southern Indian specimens new to the Survey. Mr. Shortridge tells us that a large number of specimens were collected for him by Mr. Graham. Other people besides Mr. Graham, whose names will appear in the report on the collection, rendered great assistance to Mr. Shortridge but we specially wish to mention Mr. Graham's name because, not only while Mr. Shortridge was there did he collect, but also after he left he has continued and when his specimens are sent here, it will in all probability be found that he has added one or more species to the Mammals of Coorg. Mr. Shortridge when he had finished Coorg was sent to Burma where, after interviewing different people in Rangoon and Maymyo, he started collecting in the Northern Shan States and a collection is shortly expected from him. He has received great assistance from the officials of the Burma Government, and the British India Steam Navigation Company have kindly promised to carry specimens and materials free of freight for which we are most grateful.

Our third collector, Major Mayor, arrived in Bombay in the middle of March and after a short stay here went to Ceylon, starting at Kottawa in the Southern Province. There unfortunately the weather conditions turned out to be most unfavourable but in spite of many difficulties a small collection was made and which we have since received and seems to contain several specimens of considerable interest. He is at present at Hambantota which is right in the South-East corner of the Colony. Major Mayor has received great help from the Ceylon Government who amongst other concessions have granted him a free pass for himself and his servants on the railways. It should also be mentioned that Dr. Pearson of the Colombo Museum has kindly consented to allow Major Mayor to use the Museum as his headquarters and has arranged to forward on specimens to us.

A set of specimens from the Central Provinces has been sent to the Nagpur Museum and a general set to the Indian Museum at Calcutta.

As regards finance, money is, we are sorry to say, coming in but slowly. The Government of Ceylon have however promised Rs. 2,500 and the Government of the Central Provinces a similar sum. The Executors and Trustees of the will of the late Mr. N. M. Wadia, C.I.E., have given us Rs. 500 and promised us a further sum of Rs. 500. Another member of the Tata family, Sir Dorab Tata, Bart., has generously helped us by a second contribution of Rs. 1,000, and one of the Burmese Nobles gave us Rs. 250. We must however look to the members of the Society for further contributions and we hope that every member will see his way to contribute at least Rs. 10 per annum.

MAMMAL FUND.

FURTHER LIST OF SUBSCRIPTIONS UP TO 21st JUNE 1913.

NAMES.		Amount.		
		Rs.	a.	p.
Amount previously acknowledged in Journal No. 1, Vol. XXII		47,977	9	7
Bridgeman, The Hon'ble H. G. O.		30	0	0
Burma Government		1,000	0	0
Conley, A.		15	0	0
Crawford, W. M. (I.C.S.)		30	0	0
Executors and Trustees of the late Mr. N. M. Wadia, C.I.E.		500	0	0
Hay, Capt. G. W.		15	8	0
Kemball, H. V. R.		18	0	0
London Zoological Society		748	8	7
Radhanpur, H. H. The Nawab		200	0	0
Saw Bwa Hke		250	0	0
Tata, Sir Dorab J., Bart.		1,000	0	0
Minor Subscriptions		9	8	0
Total ..		51,794	2	2
PROMISED.				
Mr. Ratan Tata (2nd donation)	Rs. 1,000			
H. H. The Rao of Cutch (2nd donation).	,, 1,000			
H. H. The Maharaja of Jodhpur ..	,, 1,000			
Government of Central Provinces ..	,, 2,500			
Government of Ceylon	,, 2,500			
The Executors and Trustees of the late N. M. Wadia, C. I. E...	,, 500	8,500	0	0
Total ..		60,294	2	2

REVIEWS.

INDIAN MUSEUM RECORDS.

Mr. Kemp of the Indian Museum accompanied the Abor expedition as Naturalist, and Volume VIII of the 'Records' is being devoted to the Zoological results.

So far two parts have been published containing eleven papers on different groups by various specialists.

Mr. Kemp is to be congratulated on his collections which have given wonderful results considering the adverse conditions under which they were made.

In the first part Dr. Annandale deals with the *Batrachia*, the *Reptilia* and the *Porifera* (sponges), describing a number of new species. The paper on *Batrachia* is divided into three parts, a systematic, a biological and a geographical. In the second part he discusses the habits of tadpoles and the way in which they cling to rocks, &c., to prevent themselves being carried away by floods. Owing to the time of the year at which it was made, the butterfly collection, reported on by Capt. Evans, contains little of interest. Writing on the *Scolopendridæ* Mr. F. H. Gravely describes two out of the eight specimens of Centipedes collected as new.

In part II Mr. H. C. Robinson writes on the Mammals, Mr. Malcolm Burr on *Dermaptera* (earwigs), while various foreign specialists report on the *Coleoptera* and Mr. Brunetti on the *Diptera*.

The Mammals are distinctly disappointing, the collection consisting of 26 species.

Mr. E. E. Green continues his notes on the *Coccidæ* (scale insects) in the Indian Museum in Part I of Vol. IX and Mr. E. Brunetti describes some new *Empidæ*. Part II of the same Volume is a specially valuable number. There is an important contribution by Signor Silvestri on some *Thysanura* (bristle-tails, fish-insects, etc.) in the Indian Museum, and in "Notes from the Bengal Fisheries Laboratory." Mr. S. Southwell writes on Trematode and Cestode parasites found in fish. The collection of Tortoises in the Indian Museum is a very complete one and for some time past Dr. N. Annandale has been occupied with a full revision of the Indian Chelonia. In the present number he has a paper dealing with Tortoises of the Chota Nagpur District.

THE GROWTH OF GROUPS IN THE ANIMAL KINGDOM. *

In his introductory chapter, Capt. R. E. Lloyd tells us that "although most biologists regard natural selection as a creative agency, yet there are dissenters from the accepted opinion" and in the following pages he brings forward some facts in support of the dissenters.

While studying the rats sent into the Indian Museum from all parts of the country, Capt. Lloyd had exceptional opportunities of investigating the great variation to which the black rat *Mus rattus* is subject to. From the material he has seen he shows that the variation in colour of the ventral surface and tail—characters used to distinguish species—are to be found amongst ordinary coloured districts. In Naini Tal, for instance, he caught two rats in the same house, the one answering to the description of *Mus vicerex* and the other that of *M. beardmorei*. Capt. Lloyd writes at considerable length on the appearance in certain towns of the white-bellied rats, the variety which in Plague Commission's reports is called

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* The Growth of Groups in the Animal Kingdom by R. E. Lloyd, M.B , D Sc.—Longmans, Green & Co., 1912, price Rs. 5.

Mus alexandrinus. He mentions a case at Poona where a small colony of these rats was discovered. They were confined to nine houses, and apparently no other white-bellied rats were found in Poona amongst the 45,000 caught between 26th May 1908 and 22nd May 1909. In Capt. Lloyd's opinion there are only two possibilities to account for these rats, the one that they were mutants and the other that they had migrated in from outside.

On page 74 a table is reproduced, giving the number of whole coloured and white-bellied rats caught in different towns throughout India to show how rare (?) this variety is supposed to be.

It is interesting to compare some of these figures with the Mammal Survey Results and as the town of Belgaum is no great distance from the Dharwar and Kanara Districts, it may well be compared with them.

	Whole coloured rats.	White-bellied.	
Belgaum..	39,460	..	Plague Commission.
Dharwar and Kanara Districts	52	43	Mammal Survey Collector.

It might also be added that out of 84 rats caught by the Survey Collector in the Central Provinces 39 were of the white-bellied variety.

Of course to a certain extent the survey specimens may be selected, but even then it shows that the white-bellied variety is commoner than Capt. Lloyd supposes. Perhaps the whole-coloured *M. rattus* may be more of a domestic animal than its white-bellied cousin.

The origin of species from mutants is discussed, and Capt. Lloyd is of the opinion that species have arisen in that way without the help of natural selection.

Towers, work on the potato beetles in America is quoted and compared with the Author's work on rats and a coloured plate is reproduced from that paper showing the different sports and mutants found amongst these beetles. In Chapter X the author points out the bearing of the mutation theory in practical matters and its connection with certain branches of pathology, especially in regard to diseases.

We can recommend this book to any one interested in evolution: it is well printed and nicely got up, but it is unfortunate that there is no index or table of contents, so that it is almost impossible to find anything without going through the whole book.

MISCELLANEOUS NOTES.

No. I.—BOLDNESS OF PANTHERS.

In February 1912 at Jamalpur in South Bihar, I was informed that near the village of Abhyapur an exceptionally large male panther was killing cattle every few nights on the outskirts of the village, and had killed a valuable bullock the previous night. I had recently had an electric lamp given me and was anxious to try it, so went out to the spot. I found the kill near a small mango tree within 100 yards of the village and 300 yards from the foot of a range of stony hills covered with thorny scrub.

I had a pole driven into the ground and hung the lamp directly over the kill, and erected a machan in the mango tree about 15 feet above the ground; the lamp switch was a cumbersome arrangement which required two hands to work, so I decided to take my shikari into the machan and get him to turn on the light when I gave the signal; unfortunately this shikari was not staunch and had lost his nerve. On two occasions I had lent him to other sahibs to assist them in following up wounded panthers, and on both occasions he had been mauled. I warned the villagers against making any noise or movement after dusk, and climbed into the machan; just as the sun was going down a dog came and started feeding on the kill but just after dusk he bolted back to the village barking and seemingly terrified, so I knew the panther was not far off; in ten minutes or so I could just dimly discern a long low shadow creeping up to the kill, and when all was comfortable I gave the sign to turn on the light but to no effect; the shikari was terrified and for some time helpless. I turned to look at him and he switched on, the panther immediately bounded 20 yards outside the circle of light, and stood looking at the lamp; I had a shot and missed and then put out the light; in half an hour the panther returned, the light was again bungled, I had another fleeting shot and missed again.

At nine o'clock a hyæna came along uttering the most unearthly yells and screams, and circled the scene of events several times, the panther was sitting directly under my machan growling and muttering, and made several rushes in the direction of the hyæna when he aproached the kill, drove him off, and then returned to his position under my tree; this continued for about two hours when the hyæna gave it up as a bad job and went off; the panther then came on the kill and was again missed; this and the succeeding shots were taken in the dark as the shikari by this time was absolutely incapable of holding the switch at all; after this a small panther (apparently the female) appeared on the scene, but the male would not allow her to feed; several times she approached the kill and each time the male darted out and drove her off; once she took refuge in the lower branches of my tree where she sat whilst they snarled at one another, this reduced my poor shikari to a jelly. Occasionally, at half hour intervals the panther would go to the kill and start feeding; I took the switch into my own hands and turned on the light, but each time directly the light appeared the panther bounded off without a moment's hesitation and stood just outside the illuminated circle. In all I had six shots, the last at about half past two in the morning, after this the panther went away altogether. The next night he did not return, although I had the kill carefully preserved on the same spot.

The night was intensely dark and I was using a high velocity rifle with a nineteen inch barrel and very straight in the stock, and I found that all my shots had gone high. This panther would not come out of the jungle on moonlight nights, but in the dark of the moon was very destructive, pulling goats and calves out of the huts. I eventually bagged him on a pitch dark night with a lethal bullet using a radium foresight; he had killed a quarter of a mile from the edge of the jungle within 30 yards of a village and was killed half an hour after dusk. He taped seven feet four as he lay and was a very heavy beast.

E. BROOK-FOX.

JUNAGADH, *May 26th*, 1913.

No. II.—THE BROWN PALM-CIVET IN NORTH KANARA.

While collecting near Castle Rock in the middle of October last Mr. S. H. Prater, assistant in the Society's Museum, shot an example of the brown Palm-Civet (*Paradoxurus jerdoni*). According to Blanford in the "Fauna of British India" this species has only been found for certain in the Palni and Nilgiri Hills. It was not obtained by Mr. G. C. Shortridge in North Kanara which points to it only being a rare straggler in that district.

N. B. KINNEAR.

BOMBAY, 28*th May* 1913.

No. III.—CHINKARA SUFFERING FROM GUINEA-WORM.

Early last March I shot a chinkara (*Gazella bennetti*) buck : the first shot struck him rather far back, the second through the shoulder; he was in good condition but the coat was staring and patchy. On examining him closely I noticed that the blood flowing from the wounds contained half a dozen thread-like semi-transparent worms varying in length from 2 to 5 inches all alive and vigorous; the animal was *hallaled* and eaten by the Mohamedan forest guards.

In Junagadh State—particularly in the south—guinea-worm is a common complaint amongst all classes, occurring chiefly in the families of those who draw their drinking water from step wells or *Vaos*.

Dr. Dave of Junagad tells me that from my description the Chinkara was undoubtedly suffering from guinea-worm.

This fact may be of interest to the medical members.

E. BROOK-FOX.

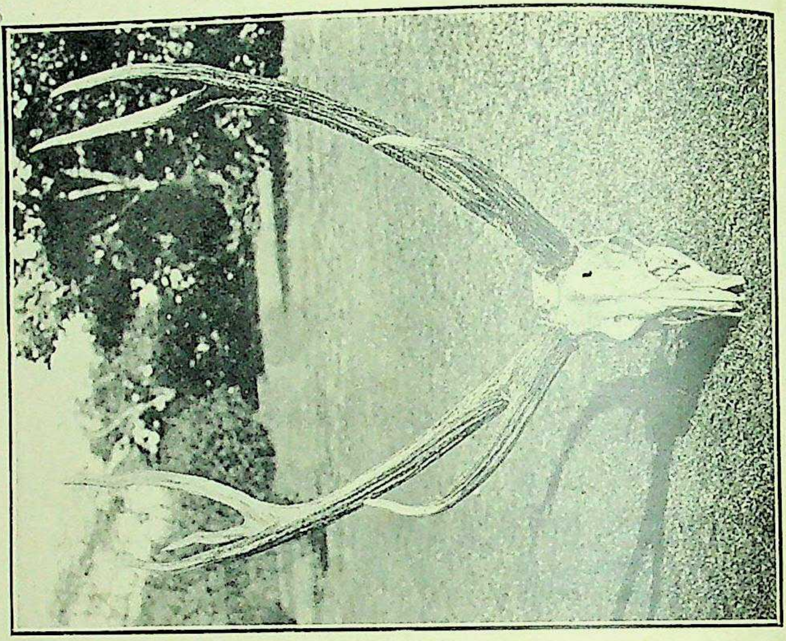
JUNAGAD, *May 12th*, 1913.

No. IV.—THE COLOURATION OF THE EYES OF THE DOMESTICATED BUFFALO.

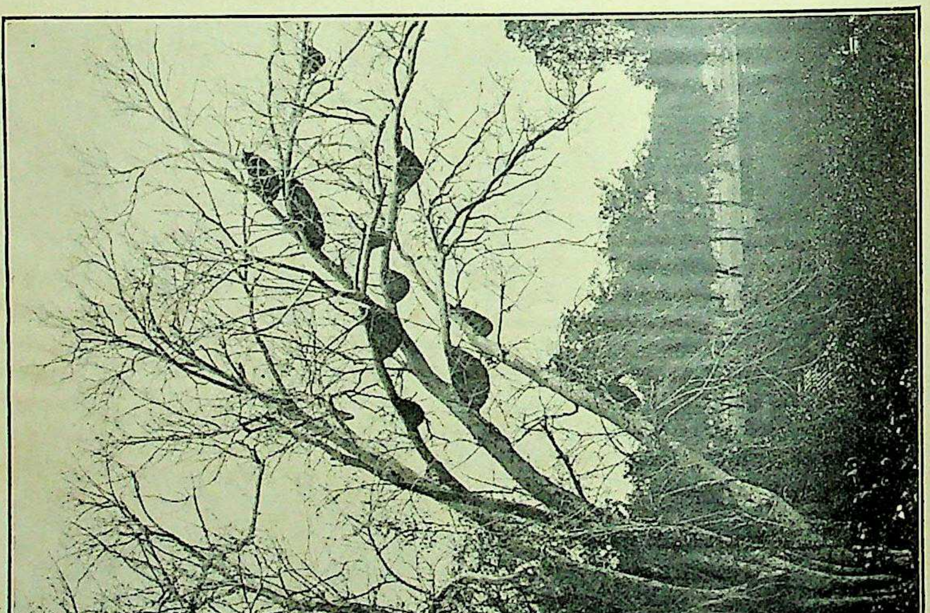
While I was shooting in the Central Provinces during March this year, I was very much struck by the number of buffaloes I met which had the abnormal pale blue iris to the eye. Not only this, but some animals had one eye normal and the other of the abnormal colour, while others had both eyes a sort of mixture of the two, a small segment of the eye only being of the normal or abnormal colour in such cases. I have often noticed this abnormal colouring of the buffalo's iris before, but never to such an extent and never before as partial or in only one eye.

C. R. PITMAN,
27th Punjabis.

CAMP, C. P.,
5th April 1913.



Large Samber Head from Panna C. I.



Swarms of Bees (*Apis indica*) on Peepul Tree.

No. V.—LARGE SAMBAR HEAD.

I send herewith a photograph (Plate A.) of a Sambar (*Rusa unicolor*) which you may like to reproduce in the Journal. I shot the Sambar in His Highness the Maharaja of Panna's jungles, and the trophy is an interesting one from the fact that there are three complete tines on the right side. The measurements can be seen from the photo reproduced. The greatest length round the curve, as can be seen from the photo, is from the burr to the tip posterior right tine which is 41 inches, and I should like to know your opinion and that of other members of the Society as to whether these horns can be in anyway regarded as a record, taking into consideration the fact that there are three tines on the right side and that one of these measures 41 inches from burr to tip.

F. D. S. FAYRER, MAJOR, I.M.S.

SUTNA, E. I. RY.,
June 3rd, 1913.

[The measurements are not shown on the block but the principal ones, not given on the table below, are as follows :—

Length of left horn 38″, length of brow outters R. 19″, L. 17¼″.

According to the latest edition of Rowland Ward's "Records" the record head measures 50⅛″ along the outside curve. There are many heads longer than that of Major Fayrer's, and in no measurement does his excel heads already obtained. Two heads with extra points are mentioned, and the measurements are as follows :—

Length on outside curve.	Circumference above brow tine.	Tip to tip.	Widest inside.	Points.
43	6½	33	35	4+3
42½	6¼	15	27¾	4+4
41	...	22	...	4+3 Major Fayrer's head.

EDS.]

No. VI.—HOW WILD BOAR FIGHT.

On the 2nd April at about 8-30 in the morning I was walking through grass jungle in the Chanda District of the Central Provinces where I was shooting.

Suddenly two Wild Boar rose out of the grass on their hind legs and fought in this position, with fore legs locked for more than half a minute.

At first they were about 60 yards off, but I got much closer and saw them on the ground rolling over and over each other, squealing and hacking at each other with their tusks.

When they eventually separated the smaller of the two came my way and I shot it. It had a very deep gash in its near shoulder as a result of the fight. The wound was nearly 4 inches long and made the pig limp.

C. R. PITMAN,
27th Punjabis.

CAMP C. P.,
5th April 1913.

No. VII.—NOTES ON THE CHESTNUT-HEADED SHORTWING.

The following notes on the Chestnut-headed Shortwing, *Oligura castaneicoronata*, may be of some interest. Oates in the Fauna of British India, Birds, Vol. I, states that this bird is found from 3,000 ft. to 6,000 ft., and also mentions it as a bird of the higher ranges of the Himalayas. It would appear to be subject to a seasonable movement, as here in the Bhutan Duars it comes down as low as 500 ft. in winter, leaving us again about the 15th of March. It is fairly common in suitable localities such as ravines, the thick brushwood on whose sides afford it ample cover. In habits it somewhat resembles the Slaty-bellied Short-wing, *Tesia cyaniventris*, but is slightly more active than that bird in hopping about and flying from bush to bush. Its loud and piercing note "seek" usually repeated twice in succession is not altogether unmusical. The following are the measurements and notes on the soft parts of a male specimen I secured: length 3′-6″; wing 1′-9″; tarsus ·92″; tail 1″; bill ·5.″ Iris dark-brown, upper mandible black, lower yellow. Legs pale reddish-brown.

H. V. O'DONEL.

HASINARA, T. E., BHUTAN DUARS,
18*th February* 1913.

No. VIII.—MISSLE THRUSH NEAR LAHORE.

Early in the year Captain C. A. Rocke sent in for identification the skin of a Missle Thrush which had been shot in the beginning of January by Mr. Joseph, I.C.S., at a place called Gugera on the banks of the Ravi, about 60 miles from Lahore. This Missle Thrush was an example of the large Eastern race *Turdus viscivorus bonapartei* which inhabits Transcaspia, Turkestan, Central Asia, Afghanistan and the Himalayas. In India this species breeds in the Himalayas and Kashmir, and is also found in the Kurram Valley and near Quetta but seldom visiting the plains.

BOMBAY. N. B. KINNEAR.

No. IX.—THE RUFOUS-BACKED SPARROW, *PASSER DOMESTICA PYRRHONOTA*, BLYTH.

In continuation of my note in the Society's Journal (Vol. XX, p. 1151), I have now to add that this species is abundant at Ferozepore, Punjab. About 5 miles from Ferozepore Cantonments, the main line of the railway crosses the River Sutlej into the Kasur Subdivision of the Lahore District. On both sides of the river large bunds have been constructed, and about them is a variety of swamp and grass jungle, broken by large Shisham and Kikur trees which grow in patches or along the bunds. This is the chosen haunt of the Rufous-backed Sparrow, which is found in fair numbers, usually in flocks, which perching among and feeding on the seeds of the tall pampas grass. They roost in parties in the thorn bushes on the bunds. I did not remain at Ferozepore long enough to ascertain whether the birds are residents, but I obtained several specimens in November and January.

HUGH WHISTLER,
INDIAN POLICE.

JHELUM,
13*th May* 1913.

No. X.—THE OCCURRENCE OF THE HIMALAYAN YELLOW-BACKED SUN-BIRD, *ÆTHOPYGA SEHERIÆ* IN THE CENTRAL PROVINCES AND EXTENSION OF ITS HABITAT.

In the "Fauna of British India" Birds, Vol. II, page 348, the range of this species is given as follows:—

"The Himalayas from Gurhwal to Dibrugarh in Assam up to 7,000 feet in summer, Cachar; Sylhet; the Khasi hills; Manipur. This species is also found in the plains, having been recorded from Seheria in Borabhoom by Tickell and an *Æthopyga* was seen in Singbhoom by Ball." It may, therefore, be worth recording that on the first of April 1913 I secured a male of this species at Laugher (1,933 feet) in the Balaghat District of the Central Provinces.

My specimen agrees with Oates' description except that the middle tail-feathers are only ·25″ longer than the rest, and there is a slight difference in the colouration of the tail, due probably to immaturity.

E. A. D'ABREU, F.Z.S.

THE MUSEUM, NAGPUR,
17*th June* 1913.

No. XI.—THE PALE SAND MARTIN, *RIPARIA RIPARIA DILUTA*. (*SHARPE AND WYATT.*)

So little is known about the distribution of this bird, that the following facts seem worthy of record. While camping along the River Sutlej in the Jellalabad Haquah of Ferozepore District last year I came upon large numbers of Sand Martins that were nesting in the sandy bank of a tributary channel of the river. I accordingly dug out many of the holes but only found 2 eggs in two nests, and 3 eggs in another, the majority of the nests being unfinished. I secured a couple of the parent birds (S. R. 547 and 548—23-2-1912) and found them to belong to this race—an identification kindly confirmed by Dr. C. B. Ticehurst. Two eggs were unfortunately broken, but the others measure as follows:—c/3, 16×13; 15·5×13; 15·5×12·5 and c/2, 17·5×13; 17×12·5.

On re-examination of a Martin obtained in September, when there were several about (S. R. 439—24-9-1911, ♀ ad.), I find it also belongs to the above race.

HUGH WHISTLER,
INDIAN POLICE.

JHELUM,
13*th May* 1913.

No. XII.—NOTES ON THE NESTING OF THE BROWN-NECKED SPINE-TAILED SWIFT, *CHÆTURA INDICA* AND THE WHITE-RUMPED SPINE-TAILED SWIFT, *CHÆTURA SYLVATICA*.

It may interest some members to know that the Brown-necked Spine-tail roosts and breeds in large hollow green trees on the Travancore hills.

I have on several occasions seen colonies of 30 to 50 birds roosting in trees, but have only just succeeded in finding them breeding. On the 12th instant I discovered a tree in which the birds were popping out and in, at the only entrance which was at a height of about 45 feet; the tree was hollow from top to bottom, and, on cutting a hole in it near the ground, I found 2 nests, each containing 2 fresh eggs. The nests were mere depressions in the earth at the foot of the tree lined with dry leaves and straw. The eggs are pure porcelain white with very hard shells, the average size of the 4 eggs is 1·28″ × 1″.

I have since tapped another tree in the same way and found three nests at the foot of it, two nests were empty and the third contained two young birds.

All the trees I have seen occupied by this Swift have been at elevations of 1,000 to 2,000 feet in heavy forest.

Since sending the above notes last month on the habits of this swift, I have been fortunate in obtaining a considerable number of their eggs. Although the birds roost in trees at times in large colonies, I have not found more than 2 pairs breeding in one tree, in most cases only one pair of birds breeds and occupy a tree during the breeding season. I have found as many as 5 eggs in a clutch but 3 or 4 seem to be the usual number.

The white-rumped Spine-tail (*Chætura sylvatica*) also breeds on the Travancore hills in open forest at elevations of about 2,000 feet. It hawks about during the day in parties of about a dozen birds, but does not breed in colonies. The nest is made of vegetable fibre, strongly attached to the inside of a hollow tree with saliva. The eggs are white and glossy, and are usually 4 in number, the average size of 15 eggs is ·64″ × ·40″.

J. STEWART.

Kalthuritty P.O., Travancore,
10*th April* 1913.

No. XIII.—EGGS OF THE MALAY EAGLE OWL, *HUHUA ORIENTALIS* (Horsf).

As the eggs of this species are seldom seen in authentic cabinets, it may, perhaps, be as well to give a short description, etc., of two clutches, which were generously presented to me the other day by Mr. E. C. Stuart-Baker, F.L.S., F.Z.S.

The eggs in question were taken on the 24th and 26th January 1912 in a range of hills, about 16 miles inland from Perak, Federated Malay States.

The normal number in a clutch appears to be 2.

The colour is, of course, spotless white. The shape of one of the clutches of eggs is a broad oval, verging almost into spherical, slightly pointed towards the small end. The shape of the other clutch is a longish oval, slightly pointed towards one end.

The shells exhibit little gloss. The texture is rough, and several white pimply lumps are scattered here and there over the large ends of the specimens. They measure:

1st clutch.	(*a*)	2·1″ × 1·7″	2nd clutch.	(*c*)	2·25″ × 1·7″
	(*b*)	2·11″ × 1·75″		(*d*)	2·22″ × 1·67″

Average mersurements of 4 eggs = 2·17″ × 1·7″.

P. T. L. DODSWORTH,
F.Z.S., M.B.O.U.

Simla, 21*st May* 1913.

No. XIV.—TAKING OF THE NEST OF THE CINEREOUS VULTURE.

Last year I received a request from a gentleman, who is an enthusiastic egg collector, to obtain for him, if possible, one or more eggs of the Cinereous Vulture (*Vultur monachus*). Major Marshall, Royal Garrison Artillery, who was then still quartered in Quetta, kindly gave me the name of a Pathan, whose home is in the Urak Valley, who would be able to show me nests of this vulture. Apparently this is the only part within Indian limits where this species is known with certainty to breed, and specimens of the eggs were obtained by Major Marshall last year. On March 31st the Pathan, Haji Nur Mahommed, came and brought me news that he had found a vulture's nest with an egg in it. I accordingly went to Urak and put up in the dak bungalow there on Friday, April 4th. The next day I started at 9 a.m., with a Pathan named Shah Nur Khan, deputed by Haji Nur Mahommed, for the vulture's nest. It was a long climb, and it took me 4 hours to reach it. The nest was an enormous collection of sticks on the top of a Juniper tree about 25 feet high, and was close up under the highest crags of Zarghun Mountain, at an elevation of at least 10,500 feet, if not more. Wherever it was not too steep for snow to lie, there was a foot of snow on the ground all round and the air was very fresh and pure. Although I felt pretty sure that the bird was *Vultur monachus*, I decided to shoot it, if possible, so as to make certain of its identity beyond any doubt. As I approached the nest the bird flew off, and I, misjudging the distance, failed to bring it down, though I saw that a couple of its large wing feathers were broken by the shot. It was, however, none the worse for this, as it swept across the valley, and then commenced to soar in ever-widening circles till it had reached a point so far up in the blue above us, that it appeared a mere speck in the sky. I sat down to take a little refreshment after my climb, and for about 20 minutes the vulture remained sailing about like an aeroplane at an immense height above us. I saw that it had no intention of coming down, while we were in view, so I sent Shah Nur Khan away, with orders to hide himself completely at some distance, while I hid myself at the very foot of the tree on which the nest was, where I had complete cover. After waiting for about an hour, I had the satisfaction of hearing the swish, swish, swish, of the vulture's wings, as it flew up and settled on the nest. After giving it a few minutes to settle down, I emerged cautiously from my hiding-place, and as the bird flew off, had no difficulty in dropping it dead, as it was quite close. It proved, beyond any doubt, to be *Vultur monachus* and measured 8 feet 11½ inches across the wings. I kept the wings, tail, head and feet, for identification purposes, if required. The egg measured 3·63 inches by 2·75 inches and is dull white, thinly splashed with dark chocolate brown, principally at its narrower end. On my way back to the Urak bungalow I discovered a nest, in the course of construction of the Eastern Rock Nuthatch (*Sitta tephronota*). These curious little birds were very busy carrying large lumps of mud from the bed of the streams to the nest, which they were building against the face of a large wall of rock.

H. DELMÉ-RADCLIFFE, LT.-COL.,
R.W.F., F.Z.S.

QUETTA, BALUCHISTAN,
10*th April* 1913.

No. XV.—VORACITY OF VULTURES IN THE GIR FOREST.

In December last whilst travelling in the Gir with Mr. Boyd, Superintendent of Police, we came across a buffalo freshly killed by lions near a Ness or a buffalo camp; as it was half moon we decided to sit up and watch the lions feed. As the surrounding trees were full of vultures the forest Guards suggested our waiting till it was fairly dark, otherwise the vultures would leave nothing for the lions; two men were left to guard the kill and they had to exert the utmost vigilance to prevent it from being devoured, several vultures being killed by sticks on the kill. When driven off they did not fly away but ran into the thick underbrush; after dusk we sat up in machans. When we were comfortably seated all vultures were driven out of the neighbouring trees and the men went away. Soon after they had gone hundreds of vultures ran out of the underbrush and in a few minutes the kill was a seething mass of birds; we whistled up the men who came up and pulled the birds off by their wings and necks and clubbed them right and left, killing several of them in the melee; the birds made no attempt to fly away but merely ran into the jungle. This continued until 11 o'clock when the men were tired and our patience worn out. We then went away and abandoned the kill which was finished off in a few minutes.

I have sat over hundreds of kills and have never known vultures to descend after dusk, the forest men of the Gir however inform me that vultures here feed at night and kills must be very carefully screened if one wishes to sit up.

E. BROOK FOX.

JUNAGADH,
12*th May* 1913.

No. XVI.—THE LUGGER FALCON (*FALCO JUGGER*, J. E. GRAY.)

10*th April* 1913, *Camp Chakwal Tahsil.* Seeing a pair of Lugger Falcons haunting a low earth cliff above a dry watercourse near a village, I went to investigate. The birds kept on perching on various points along the cliff edge, thence launching forth in pursuit of passing Kites; from time to time they would settle in small hollows on the cliff face, behaving in such a way as to make me feel sure of the presence of a nest. There were two rather battered looking stick nests near together on the face of the cliff, one in a fissure and the other on a ledge. The ledge nest was so situated as to be visible from the top of the cliff, so sending my orderly round to look into the nest I sat and watched the graceful movements of the Falcons as they "stood on" in the air above the cliff or wheeled round to take up a fresh position near by; occasionally they would settle for a short time on the cliff. While I was waiting a pair of Ravens, who had appeared once or twice before, settled on the ledge by the nest and proclaimed their ownership so loudly that I thought they must have young—however the nest was empty as also proved to be the one in the fissure. While I was waiting for ropes for the investigation of the second nest I had been much amused by the way the Falcons had treated the Ravens. I saw the Falcon making several stoops in the direction of a heap of debris at the bottom of the cliff some little way from the nests I was examining. The glasses shewed that the object of these stoops was the pair of Ravens who cowered down in crevices amongst the debris every time the falcon swished close above their heads. My attention was temporarily diverted and I returned to the falcons to find that one Raven has escaped but the other was still under fire. It was trying to hurry away from the forbidden spot (which afterwards proved to be hard by the Falcon's nest), shambling along uneasily on foot along the base of the cliff, and croaking most dismally. Every few seconds it had to cower against the cliff to escape the indignant Falcon who was making a succession of splendid stoops, passing every time within an inch or two of the Raven's devoted head. I could not make sure whether the Falcon was in earnest and trying to strike the Raven or whether she was satisfied with giving him a good fright.

It was now growing late and I had begun to despair of finding the nest as there seemed no more likely spots on the cliff; there was a hole, it is true, in one place from which one of the birds had dashed out but this was only a roosting place. However just as I was leaving I saw a stick or two in a norrow vertical crack eaten out by rain water down the face of the cliff, and the glasses revealed the existence of a small chamber in the cliff behind the sticks—here was the nest. A boy went down on a rope next morning and brought out the solitary young bird which was in down and only a day or two old. As the down plumage is not described in the Fauna of British India I append a description.

13*th April* 1913, *Camp Chakwal Tahsil.* I found a nullah near my camp which ended in a miniature cliff basin—the sides being formed of low sandstone cliffs worn into ledges. As I looked down into the basin from on top of the cliff a Lugger tiercel dashed away from one of the ledges below me; however the only nest I could see was an untidy Neopheon's on which the old bird was brooding a single egg. Walking round the cliff on one side of the basin I caught sight of the Lugger Falcon squatting on a ledge of the opposite cliff. I could not make out what she was doing as there was no nest and beside her was something white. Field glasses were taken out and shewed that she was brooding young birds in down; crossing over I was able to walk up the debris at the base of the cliff to within a few feet of the ledge—the bird not moving until a stone was thrown up. The ledge was then reached and 5 young birds in down but with the quill feathers sprouting well were found lying on the sand and pebbles that strewed the ledge. There was no vestige of a nest and there was no nest in the nullah from which they might have been removed. The nestings were noisy when moved and inclined to resent being touched. I took one of them and reared it successfully, so for purposes of reference I have recorded below a full description of the 1st plumage.

17*th April* 1913, *Banks of R. Jhelum.* Went to examine a nest of *Haliætus leucoryphus* which had been reported. I arrived to find it an enormous structure at the top of a large cotton tree which was only scaled with the greatest difficulty. When I arrived a Lugger Falcon was perched near the nest and she kept on coming back to the tree and perching and calling, or making vicious stoops at the Parrakeets and doves that were in the tree. Indeed I felt sure that she had a nest near and would have suspected her of appropriating the Eagle's nest, had not my informant assured me that he saw the Eagle at the nest daily—so much for the veracity of the native! When the nest was reached it was found to contain the Lugger's two eggs—moderately incubated. She had not troubled to remove various relics of the real owners of the nest—a fish skeleton, and the beak and portion of the leg bones of a Heron.

For the sake of completeness in describing the various nesting sites used by this falcon I include the following nest though it was not found in Jhelum District.

25*th February* 1912. *Jellalabad, Ferozepore District.*—Close to my camp there was a nest of the Lugger Falcon in a kikm tree; this was a large bulky structure placed on a sloping bough at no very great distance from the ground; contained 3 fresh eggs. The male was caught in a net baited with a live bird; the female continued to haunt the nest after the eggs were taken.

Description of Down Plumage.—Colour of skin plumbeous bluish-grey; moderately well covered with white down, very slightly tinged with grey; young quills contained in blue black cases. Iris, brown; bill, cere, and eyelids, dull plumbeous blue; tarsus and feet, dull plumbeous grey; claws blackish, egg tooth, very small, white.

Description of first plumage.—Age about one month. The entire head and neck are pale buff with a creamy almost pinkish tinge and marked with dark-brown as follows:—the forehead with very narrow shaft streaks; the crown with broad shaft streaks, the feathers being almost entirely brown in two patches above the supercilia; a narrow line above the eye below the bare ledge; a slight patch below the front of the eye, continued below the gape in moustachial streaks that meet the dark breast; a broad line from the eye, above the earcoverts, produced to meet the dark colour of the back. The earcoverts, chin, and throat are tipped with arrow marks of a lighter brown; the feather bristles of the lores have black ends.

The upper parts from the lower neck including the tail and wings are dark sooty brown with a dark bluish sheen, all feathers edged with pinkish brown, the edges growing more pronounced on the wing coverts and rump; the tail with a terminal bar of pale buff, about half an inch wide, and with some pinkish buff markings on the basal portion of the inner webs. The wing quills spotted with pinkish buff. The edge of the wing pale buff. The underwing coverts dark-brown with buff and rufous edges, the larger feathers, being only tipped with those colours, and with a spot on each side of the shaft near the base. Axillaries similar but wanting the basal spot.

The underparts from the throat are very dark-brown with the base of the feathers, buff in varying degrees—the buff being more or less visible; the flanks edged with buff. Vent and undertail coverts very dark-brown with buff tips, the brown being partly concealed.

H. WHISTLER, M.B.O.U.,
Indian Police.

JHELUM, 12*th May* 1913.

No. XVII.—OCCURRENCE OF THE EMERALD DOVE, *CHALCOPHAPS INDICA* (LINN) IN THE SIMLA DISTRICT.

Last February, I came across this species on several occasions, in a wooded ravine, about 30 miles east of Simla, elevation 5,000 feet. Strange to say, however, I found it nowhere else in these parts. It is possible I may have overlooked it, and that it extends throughout the lesser ranges of the Punjab Himalayas. Its extreme western range is still doubtful—it is apparently not Kashmir proper, as Ward is emphatic that it does not occur in that country.

P. T. L. DODSWORTH, F.Z.S., M.B.O.U.

SIMLA, 21*st May* 1913.

No. XVIII.—MIGRATION OF FULL SNIPE.

As I was riding along the left bank of the old bed of the Ravi at Sundhar Chak at 5-30 p.m. on the 10th May, I saw a full snipe *Gallinago cœlestis* flying due north up the millstream. A half gale and dust-storm was blowing from the north at the time, and the bird seemed to find some difficulty in making headway. I saw him rise and make a flight of about 50 yards, then flushed him, and sent him another 50 yards. He went away quite silently and my first impression was that he was a wounded bird. But when I flushed him a second time he went away very strong indeed right in the teeth of the wind and almost straight. I then concluded that he was flighting to the hills. Sundhar Chak is about seven miles below Madhopur where the Ravi debouches from the hills. The Ravi water is barely 60° F. at this time of year and never rises above 76°, so perhaps migrants who frequent land watered by it are enabled to make better weather of the heat in May here than in other places. Snipe were about in the Permanand *jhil* on April 5th, but had by then evidently started to migrate; and I suspect that my friend of May 10th was very belated in his movements.

G. C. L. HOWELL.

MALIKPUR, UPPER BARI DOBAB CANAL,
13*th May* 1913.

No. XIX.—BAER'S POCHARD, *NYROCA BAERI* AND OTHER RARE DUCKS IN MANIPUR STATE.

I am sending to you by registered post two duck skins, one is undoubtedly a male specimen of Baer's pochard, or the Eastern White-eye *Nyroca baeri.* It is, as far as I know, the first specimen obtained in Manipur and was shot on Ekop jhil, some 12 miles south of Imphal, on 15th March 1913, by Col. W. Campbell of the Black Watch.

The second specimen I believe to be a female Baikal or Clucking Teal *Nettium formosum.* I have consulted Oates, Stuart Baker, Hume and Marshall, Finn and LeMesurier and the plumage seems to me to leave no doubt that the bird belongs to this species. But a keen and expert Ornithologist up here holds the opinion that it is not a clucking teal on the ground that the feet and legs are not of the colour usually given in the text books. I shall be grateful if you will kindly confirm my identification or inform me what the bird really is. I shot it out of a flock of 8 or 10 on Ekop on 16th March 1913. The skin is unfortunately not in good condition as the bird dived and was somewhat damaged by the boatman killing it with his paddle.

The following other rare or locally rare birds have been accounted for since I have been here :—

(1) Mallard, *Anas boscas*—Mr. Stuart Baker only records one instance of Mallard having seen in Manipur. This year, however, Col. C. E. Nichol, R.A.M.C., saw one on the Logtak Lake on 20th February 1913, Mr. F. B. Blackie saw 4 on a jhil a little south of the Logtak on 3rd March 1913, and Mr. R. E. Forrester of the Black Watch shot a single drake on Ekop on 16th March 1913.

(2) Pinkheaded Duck, *Rhodonessa caryophyllacea.*—I saw a pair with a flock of Spot Bill on Senaput, 10 miles S. W. of Imphal on 23rd October 1910 and shot the male.

(3) Nukhta, *Sarcidiornis melanonotus*—Mr. A. H. D. Barron of the 17th Infantry shot a pair last year.

(4) Common Sheldrake, *Tadorna cornuta.*—A shikari shot one in 1910.

(5) Bronze-capped Teal, *Eunetta falcata.*—Col. H. C. Tytler has a beautiful specimen of a male in his Tealery, which was brought in two or three months ago, having been caught in a net.

(6) Hume's Bush Quail, *Microperdix manipurensis.*—Mr. F. B. Blackie shot two specimens in the S. W. corner of the valley on 24th February 1913. The skins of one has already been sent to the Society by Col. H. C. Tytler. Both were males, but must have been immature as the plumage of one exactly resembled the description given of the female, while the second had the characteristic bay marking of the face only very slightly developed.

J. C. HIGGINS, I.C.S.

IMPHAL, MANIPUR STATE,
28*th March* 1913.

[The Baer's pochard was a very fine specimen and the teal was undoubtedly a Backal Teal. Both birds are welcome additions to the Society's collections—EDS.]

No. XX.—DUCK IN BURMA.

On page 1085 of the Journal, Vol. XXI, No. 3, Major Harington gave a list of the bags recorded from Tongyi and Nyaungwun at Christmas 1912.

The attached list will serve as an appendix to his note, and gives the bag of two parties at Tongyi and Nyaungwun respectively :—

	Tongyi	Nyaungwun.
Gray Lag Goose (*Anser rubirostris*)	14	22
Bar-head Goose (*Anser indicus*)	..	..
Brahminy Duck (*Casarca rutila*)	1	1
Nukhtas (*Sarcidiornis melanonotus*)	2	..
Burmese Grey Duck (*Anas haringtoni*)	12	8
Chinese Grey Duck (*Anas zonorhyncha*)	..	..
Pintail Duck (*Dafila acuta*)	7	13
Gadwall (*Chaulelasmus streperus*)	7	..
Wigeon (*Mareca penelope*)	..	..
Shoveller (*Spatula clypeata*)	6	4
Tufted Duck (*Fuligula fuligula*)	15	36
Common Pochard (*Nyroca ferina*)	..	..
White-eyed Pochard (*Nyroca africana*)	5	..
Common Teal (*Nettium crecca*)	26	68
Garganay Teal (*Querquedula circia*)	39	7
Cotton „ (*Nettopus coromandelianus*)	11	..
Whistling „ (*Dendrocycna javanica*)	15	..

At Nyaungwun this year there was a lot of water and birds were not plentiful, except Tufted Duck who were in flocks on the open water.

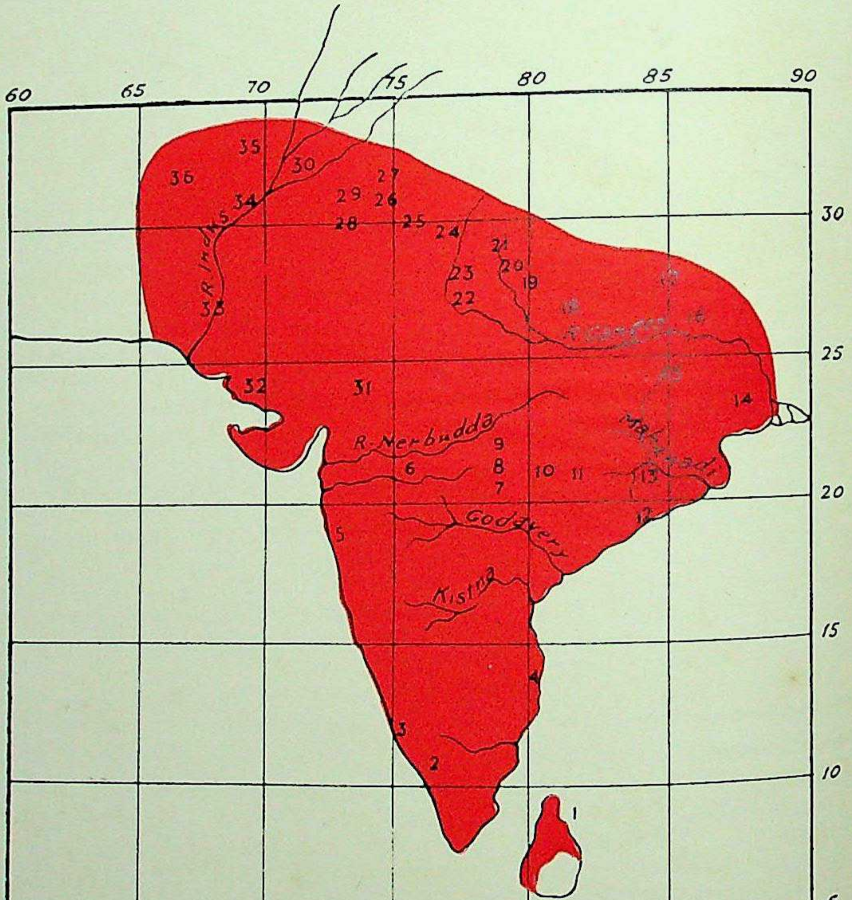
C. N. BELL, I.C.S.

MANDALAY, 22*nd March* 1913.

No. XXI.—A RARE SNAKE *ELACHISTODON WESTERMANNI* FROM THE JALPAIGURI DISTRICT.

Our Society's collection of snakes has been enriched by a specimen of this rare snake sent by Mr. W. L. Travers among many interesting species collected in the Jalpaiguri District. The species was described in 1863 from a specimen obtained at Rungpore which is preserved in the Copenhagen Museum. A second specimen is in the Indian Museum, Calcutta, and was found at Purneah. The Jalpaiguri specimen is the third known. I have examined the last two specimens, and have notes furnished me by the Superintendent of the Copenhagen Museum on the type specimen, so that I feel justified in giving further details of the species. The Jalpaiguri specimen may be described as follows : *Length* 2 feet 6 inches, tail 5 inches. *Ventrals* 213. *Anal* entire. *Subcaudals* 62, divided. *Costals* two headslengths from head 20, midbody 15, two headslengths before vent 15 ; the rows become 19, about two headslengths behind the head and reduce to 17 ; three headslengths behind the head by a fusion of the 3rd and 4th rows above the ventrals ; they further reduce to 15 by a fusion of the two rows next to the vertebrals on each side, about four to four-and-a-half headslengths behind the head ; vertebrals are very distinctly enlarged, the breadth being subequal to the length, and as broad as the last row of costals ; the scales other than those in the vertebral and ultimate rows are slightly oblique and smooth.

Rostral.—Large, touches 6 shields, the rostro-internasal sutures being as long as the other two sutures taken together. *Internasals.*—The suture between them equal, the inter-præfrontal suture about three-fifths the internaso-præfrontals. *Præfrontals.*—The suture between them is about two-thirds the præfronto-frontal suture ; touch the internasal, postnasal, loreal, præocular and supraocular. *Frontal.*—Touches 6 shields, the præfronto-frontal sutures rather longest, the præfronto-parietals rather shortest.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R. Indus
R. Nerbudda
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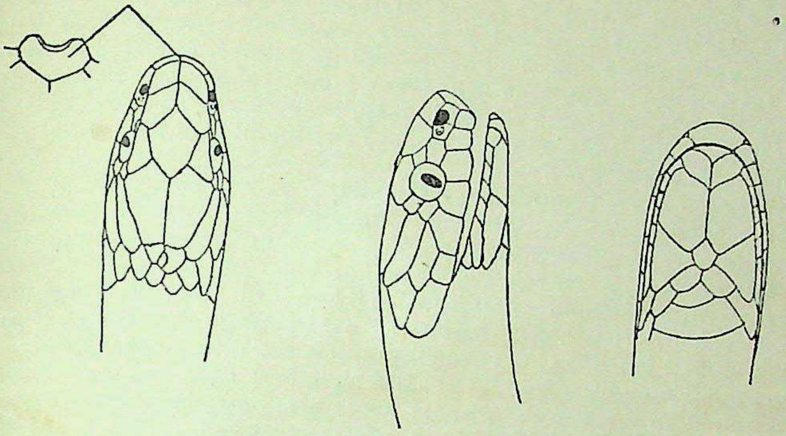
To show distribution of 15 scaled Kraits—Ventrals 195-223, subcaudals 36-53. (From records referring to 137 specimens in my note books.)



Elachistodon westermanni (Slightly enlarged).

Supraoculars.—Length about three-fourths the frontal, breadth less than half the frontal along a line connecting the centres of the eyes. *Nasals.*—Divided in contact with the 1st and 2nd supralabials, a dimple in the posterior shields. *Loreal.*—In contact with the eye. *Præocular.*—One small above the loreal. *Postoculars.*—Two. *Temporals.*—Two anterior, the lower touching the 5th, 6th and 7th supralabials. *Supralabials.*—7th, the 3rd and 4th touching the eye, 7th much longest. *Infralabials*—seven, very narrow; the 5th, 6th and 7th, touching the posterior sublinguals. *Sublinguals*—Two large and broad pairs, with no mental groove separating them. *Eye* moderate with vertically eliptic pupil. *Head* rather elongate. *Body* compressed. *Colour*—Black above, with a conspicuous light-brown vertebral stripe from the neck to tail tip, and a few short variegations of the same colour costally. Head light brown with a large black sagittate mark, a black stripe passes through the lore to well behind the eye. Chin, throat and belly uniform, yellowish with some black basally on each side of the ventrals. No maxillary teeth, but one (two ?) large grooved fangs at the posterior limit. Four (?) small palatine teeth with a long edentular internal before and behind. No (?) pherygoid teeth.

The specimen in the Indian Museum agrees except *Costals*, two heads-lengths behind head 19. The two steps from 19 to 17 and from 17 to 15 are intermixed but the fusion of rows is as above. *Ventrals* 208, *Subcaudals* 63. *Supralabials* 6 on the right side.

In the type specimen the costal rows are 19 at a point two headslengths behind the head. The ventrals are 217 and subcaudals 59 (Gunther).

F. WALL, MAJOR, I.M.S., C.M.Z.S.

ALMORA, 4*th June* 1913.

No. XXII.—ON THE COMMON (*BUNGARUS CÆRULEUS*) AND SIND KRAITS (*BUNGARUS SINDANUS.*)

Among other specially interesting specimens sent to me by our Society recently are two kraits which it seems to me justify the conclusion that *Bungarus sindanus* cannot in future be considered a species apart from *Bungarus cæruleus*. Specimen No. 1 was obtained by Captain F. L. Hughes at Jhelum.

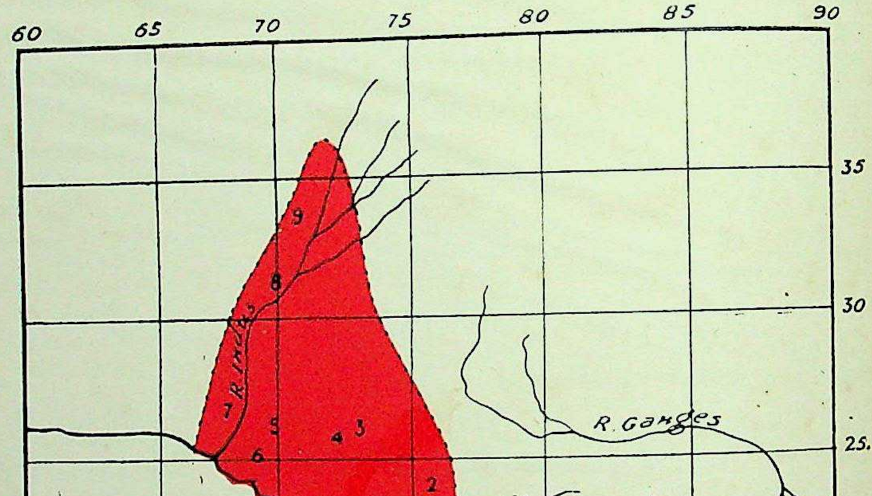
It is peculiar in that the scales are in 17 rows in the whole bodylength. The scales in the vertebral row are decidedly broader than long, the ventrals 206, subcaudals 43, and the 2nd supralabial is not narrower than the 1st and 3rd. The body is as far as I can judge not compressed. In all particulars excepting the scale rows, the specimen agrees with typical *Cæruleus.* This is the first krait I have any knowledge of with 17 rows of scales from the Punjab.

Specimen No. 2 is still more interesting. It was collected at Sholapur (Lat. 17° Long. 75°) by Mr. R. E. Macpherson. This specimen also has 17 scale rows in the entire body. The scales in the vertebral row are as broad as long, the ventrals 194, subcaudals 44, and the 2nd supralabial is very slightly narrower than the 1st and 3rd. If anything the body is depressed rather than compressed. It is among other things remarkably coloured and is perhaps a melanotic specimen, being quite black dorsally except for a series of white distant vertebral spots. Low in the flanks corresponding with some of these spots are very short indistinct indications of a cross bar which is otherwise suppressed. Here again the most important characters in identification are in agreement with *cæruleus*, the scale rows being the only exception.

Hitherto I have never seen a *Bungarus* south of the Ganges basin and Rajputana with 17 scale rows. Again I have only seen one *Bungarus* from Baluchistan with 15 scale rows, they all have 17 usually. The new conception of the species finds a very good parallel in the case of the Cobra *(Naia tripudians).* Specimens of variety *typica* from the south part of the Peninsula usually have 23 to 25 scale rows in midbody, whilst those in the Punjab and the Western Himalayas have usually but 21.

I have 5 skulls of *cæruleus* in my collection from Fyzabad and Almora, and 2 of kraits. I have hitherto called *sindanus* from Indore, and Fort Sandeman. A very critical examination of these side by side reveals to me nothing distinctive in the cranial osteology or dentition that might lead one to suppose they were different species. The dentition is as follows:—

Scale rows.		Teeth.					Habitat.
		Fangs in maxilla.	Teeth in maxilla.	Palatine.	Pterygoid.	Mandibular.	
15	Left ..	2	4	11	11	16	Fyzabad.
	Right ..	2	4	10	11	15	
15	Left ..	2	4	11	9	16	Do.
	Right ..	2	3	11	9	16	
15	Left ..	2	4	12	10	16	Do.
	Right ..	2	3	14	13	16	
15	Left ..	2	4	13	12	15	Do.
	Right ..	2	4	14	14	16	
15	Left ..	2	3	14	11	14	Almora.
	Right ..	2	3	12	10	15	
17	Left ..	2	4	12	12	?	Indore.
	Right ..	2	4	14	12	19	
17	Left ..	2	4	13	17	18	Fort Sandeman.
	Right ..	2	4	14	16	19	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R. Indus
R. Ganges
R. Nerbudda
Mahanadi
Godavery
Kistna
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To show distribution of 17 scaled Kraits—Ventrals 194-237, subcaudals 43-52. (From records of 19 specimens in my note books)......implies uncertain limits.

A summary of all the kraits upon which I have notes, which have been referred by me to the two supposed species (now united) may prove instructive to others, and I have shown their distribution on the accompanying maps :—

LOCALITIES ON MAPS.

MAP C.

1. Ceylon.
2. Trichinopoly.
3. Cannanore.
4. Madras.
5. Bombay.
6. Khandwa.
7. Wardha.
8. Bhandara.
9. Pachmarhi.
10. Raipur.
11. Bilaspur.
12. Berhampore.
13. Sambalpur.
14. Kalna.
15. Gaya.
16. Godda.
17. Champaran.
18. Fyzabad.
19. Sitapur.
20. Bareilly.
21. Almora.
22. Agra.
23. Delhi.
24. Dehra Dun.
25. Umballa.
26. Jullundur.
27. Bakloh.
28. Ferozepore.
29. Lahore.
30. Multan.
31. Saugor.
32. Bhuj.
33. Sukkur.
34. Dera Ghazi Khan.
35. Bannu.
36. Sharigh.

MAP D.

1. Sholapur.
2. Indore.
3. Marwar.
4. Jodhpore.
5. Jessalmere.
6. Umarkot.
7. Sukkur.
8. Fort Sandeman.
9. Jhelum.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

ALMORA, *4th June* 1913.

No. XXIII.—AN UNUSUALLY LARGE SEA-SNAKE (*DISTIRA BRUGMANSI*).

Whilst at anchor in Penang Harbour last year, I was leaning over the rail watching some small fish, when my attention was called to a large sea-snake swimming by the ship. I immediately called two lascars and sent them away in a boat with sticks, to try and catch it; they however were afraid to go close to it, but managed, after a lot of bad shots to strike it on the head with a stick, which stunned it; by this time I had a line ready, with a slip knot at the end, and by good luck, flung the loop just over its head, and we hauled it up on deck. The moment it was on deck though it came to life again and got out of the loop of the line. The boatswain and carpenter arrived by this time with more sticks, and we had quite a lively time, owing to there being not much space to jump about in; we struck at it several times, missing of course, much to the delight of the passengers, who were collected along the hurricane deck rail, watching the sport and giving advice. At last I got in a blow, which again stunned it, we then quickly tied a stout piece of logline round its neck; the boatswain and myself pulled together with all our might and tried to choke it. The snake however refused to be choked in this way, so after about half an hour we hauled it on to the forecastle head and hung it up in the rigging, so that its whole weight came on the cord round its neck; even then I regret to say it took a very long time to die.

The same evening after leaving Penang we cut it down and with the assistance of the ship's surgeon started to skin it, as I had no means of preserving the whole specimen, which was a great pity as this was the largest sea-snake I have ever seen. It measured 9 feet from snout to tip of tail, its colour was black, with yellow bands on back and bright yellow on belly; it had a flat tail, something like an eel; it had plate shields on the head and two large fangs in the upper jaw; these I removed and kept; it was evidently poisonous as the fangs were hollow.

We made rather a bad job skinning it, as the butcher came along and would help, which made too many cooks; the surgeon also wanted the heart to examine and in his hurry to get it, made several bad cuts in the body, just where the heart wasn't, it not being in the place he thought it would be.

Its scales were very thin and during the process of skinning nearly all came off. When skinned we nailed it on to a 10 feet board and dried it.

I have the skin and fangs now, but very much regret not being able to have kept the whole specimen for proper examination.

F. H. S. STONE.

P. & O. S.S. ARCADIA,
BOMBAY, 15th *February* 1913.

Mr. Stone very kindly submitted the skin of the snake referred to above for my examination. It measured 8 feet 9 inches, part of the head being imperfect. With a certain degree of doubt I am of opinion that the specimen is Brugman's sea-snake *Distira brugmansi* (Boie). The various details I observe agree with those of that species. The costals two head lengths from the head are 30, midbody 33, two head lengths before vent 32, imbricate. The ventrals are entire everywhere, and are about 366. I think I see a single temporal on the left side, and two cuneate scales after the 3rd infralabial.

Dorsally it is olive-green, each scale being heavily bordered with black to form a reticulate pattern (skin varnished). The subcosta is of a paler hue, and the reticulation fainter, becoming entirely lost in the last five rows. There are 53 bands on the body, black dorsally where they involve 2 or 3 rows in the body length, fading at midcosta, and indistinct below this. The intervals involve from 5 to 7 scales. There are intermediate black spots in five consecutive spaces on the vertebral region, in the middle of the body, in the last interval, and the first two intervals on the tail. The bands are not connected ventrally.

This is much the largest genuine sea-snake I have any knowledge of.

F. WALL, C.M.Z.S., MAJOR, I.M.S.

ALMORA, 4th *June* 1913.

No. XXIV.—ON THE HABITS OF THE ROCK LIZARD (*AGAMA TUBERCULATA*).

As Boulenger in his "Reptilia and Batrachia," Fauna of British India, makes no mention of the habits, etc., of this species, the following particulars may be of some interest:—

This Agama is the common Rock Lizard of these parts, and is usually to be seen either solitary or in pairs. It lives entirely in holes, crevices of rocks, and stone-walls, over which it crawls with great facility. Its diet consists of ants, butterflies, and other such like insects. My friend, Mr. J. Fairley, informs me that these lizards are very destructive to plants, and that he has frequently seen them nipping the petals off the flowers in his garden.

During the cold weather it hibernates, but a few are occasionally to be seen basking in the sun on bright days. In the summer months it becomes very abundant. I have frequently noticed it drinking water from the streams; though some of these lizards, inhabiting the tops of dry hills, must never drink.

It breeds during May, June, July, and perhaps the first half of August. A female killed in May was found, on dissection, to contain 7 eggs, which were ready for expulsion. Another killed on the 30th June had 9 eggs.

During the breeding season the males are very pugnacious, and are often to be seen fighting and chasing each other. One of these battles, which I happened to witness some years ago, lasted for several minutes, and both the combatants appeared to have suffered, and were much exhausted. I have frequently seen these lizards going about with only the stumps of their tails—the rest of the appendages having come to grief in some way—and it is very possible that these injuries, to a large extent, are due to love encounters.

P. T. L. DODSWORTH, F.Z.S., M.B.O.U.

SIMLA, *May* 1913.

No. XXV.—SIZE OF *BARILIUS GUTTATUS.*

In the Fauna of British India Day gives *Barilius guttatus* as known up to 7 inches. It might be of interest to record that I caught one of this species in the Gunzalin River (Salween District) weighing ½ lb. and measuring 9¾ inches from the fork of the tail or 10¾ inches from tip to tip. This fish, a female, contained ripe ova on the 3rd February, a full month earlier than I have known any species of carp to be ready to spawn in this river.

J. B. MERCER ADAM, F.C.H., I.F.S.

MOULMAIN, LOWER BURMA,
16*th February* 1913.

No. XXVI.—RECENT OBSERVATIONS ON THE MURRAL (*OPHIOCEPHALUS STRIATUS*).

Definite information as to the spawning habits of Indian fish is hard to come by. And the average Indian angler, keen observer though he frequently is, is neither a subscriber to scientific journals nor conversant with the somewhat specialised language of icthyologists. No apology therefore is needed for introducing to his notice an interesting discovery relating to the nidification of one of the best of the Indian sporting and food fishes.

Those who wish to read up the subject in full detail should buy "Spolia Zeylanica"[1] Vol. VI, Part XXIII, December 1909.

The article is headed "Observations on the Nests, Eggs, and Larvæ of *Ophiocephalus striatus*," and the author, Dr. A. Willey, has a world wide reputation as an accurate observer.

It is necessary at the outset to issue a warning. Dr. Willey's observations were confined to one only of some 30 known species of Ophiocephaloid fishes, viz., *Ophiocephalus striatus*. It is not proved that the other *species* have the same or even similar habits. And there is, therefore, a wide field for further observation by sportsmen and naturalists, for three species occur in Africa, and the others "in Southern and Eastern Asia and the islands to the southward. In the Philippine Islands are found at least 5 species."[1] There are six species in India which grow to three feet and over and are known as "Murral" among Europeans, and "Saul" in the vernacular of Northern India: with three smaller species called Black Caboose in English and Dhok or Dhaula in Hindustani. The *locus classicus* for the habits of the fish from the angler's point of view is Chapter XVI of Thomas's "Rod in India." Generally speaking, the fish is to our sportsmen the oriental counterpart of the pike and is fished for in the same way and with the same tackle.[2] They "inhale the atmosphere direct."[3] They will in fact suffocate if they are prevented from rising to the surface to take in oxygen. Their capacity for surviving is almost unlimited. They can bury themselves in the mud of a rain fed tank, æstivate through the longest drought when the tank dries up and come up smiling and hungry with the burst of the monsoon. "In China they are often carried alive in tubs or pails of water, and slices are cut for sale as wanted, the fish selling dear while it retains life, while what remains after death is considered as of little value."[4] These unfortunate fish, be it noted, are disembowelled before this dreadful process begins! Finally they can travel considerable distances on land in the rains when both the ground and air are moist, using their pectoral and caudal fins alternately in a manner which renders the progression a true "crawl;" and their migrations from pond to pond—generally at night—are matters of common knowledge throughout India.

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[1] Colombo. H. C. Cottle, Government Printer, Ceylon. Copies may be obtained from the Director, Colombo Museum, post free, for R. 1·25; or from Messrs. Wyman & Sons, Ltd., Fetter Lane, E. C., for 2s. 7½d.

Their flesh is really excellent: and they can be served without bones. And it is thus evident that the "snakeheads" have two characteristics valuable from the fish culturist's point of view, edibility and extreme hardihood. Accordingly in the days before British rule, when fish culture was (alas!) a less neglected science than it is now, "murral" were freely used to stock ponds of all kinds. Probably our Mussalman predecessors knew a good deal about their spawning habits. But until 1909 we knew very little indeed. Day (1883) recorded that one species *O. striatus* made a nest and that the male of the species guarded the young. But of the actual form of the nest—oviposition—and development to the fry stage we had no written account until Dr. Willey published his paper in Spolia Zeylanica. And even now—the warning can hardly be repeated too often—our knowledge is confined to one species.

Like a wise man Dr. Willey went to a local fisherman for his first information: an old "poacher" (he deserves the name) who lived by the manufacture of the basket traps in which murral are caught on their nests in Ceylon and in the Punjab. This man showed him five nests on the first day of investigation. Apparently the nests were built near the margin of the Minneri tank and were constructed with the parent fish's tail. The nest is unfortunately not figured in the journal. But it consists of a more or less circular patch cleared of weeds at the water's edge: this is filled with a mass of eggs which, unlike the eggs of most fresh water fish, *float on the surface.* These Dr. Willey found to be "characteristic translucent golden yellow and amber coloured eggs some newly hatched, spread like a sheet flush with the surface in a subcircular area behind a tussock of rushes which partly served to filter the direct rays of the sun. Amongst and around the eggs were scattered the usual detached fragments of herbage consisting chiefly of aquatic plants."

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[1] Parental Care among Fresh Water Fishes, by Dr. Theodore Gill. Annual Report. Smithsonian Inst. 1905. Washington. 1906, page 490.

[2] Thomas's Rod in India, page 227.

[3] Thomas, op. cit. page 233.

[4] Gill, op. cit. page 492.

Dr. Willey "did not see the adults, but the man said both parents had been near the nest, the smaller of the two aggressively protecting it: he called this one the female, not knowing that amongst fishes the male is smaller than the female."[1]

The paper is based on the observation of four separate broods. The egg had a diameter of about 1·25[2] mm. = 048″ and over 100,000 to the quart: nothing is said as to whether they float individually[3] or in agglutinated masses but apparently they are non-adhesive. They "lie immediately below the surface film of water exposed to the quickening influence of air and sun," and accordingly hatch out quickly. Dr. Willey thinks "within three days after oviposition and perhaps within twenty-four hours."

Gill mentions (op. cit. page 492) that the ophiocephalids mostly breed twice a year: and the fact that the ova were found by Dr. Willey in Ceylon on February 21st, May 28th and June[4] 1st seems to bear out this theory. At any rate it is an indication of the fecundity of the species and its adaptability to piscicultural methods.

It is unfortunately impossible to reproduce the drawings Dr. Willey has made to illustrate his researches. The eggs "owe their buoyancy to the presence of a single large oil-globule which occupies the greater part of the ovum and is immersed in the golden yellow yolk." From this condition "as seen with a simple lens at 5-30 p.m. we reach overnight the stage * * * * * where the body of the embryo encircles about two-thirds of the yolk like a belt. The surface view shows that while the head is still oppressed to the yolk, the tip of the tail is becoming folded off: the eye and the auditory vesicle are also present. A few hours later the heart begins to beat and the tail to twitch." And in a short time the embryo breaks the outer covering or vitelline membrane and emerges as a *larva* or as trout breeders say an alevin measuring 3·5 mm. or 0·137.″

"For three days the larvæ remain at the surface of the water, resting on one side of the yolk-sac up," and exhibiting when they swim the helplessness usual in fish at this period of their development. During the first day or most of it "the eyes are clear and devoid of pigment" which makes it difficult at the first glance to distinguish the fact that the fish have hatched out. But black pigment appears in the eyes on the second day and by the third day the larvæ are 5 mm. (0·196″) in length. They are still incapable of resting at the bottom. On the fourth day the larvæ are 6·75 mm. (·265″) in length and can swim freely at all levels: and on the fifth, the yolk-sac is absorbed. Dr. Willey has recorded his observations in very full and lucid detail: he kept his fry in a small enclosure in a glass tank and his records will be of the greatest value to the biologist and fish culturist. For the purposes of this paper however his summary of the chronological data available will suffice. This reads :—

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[1] The generalisation is not quite justified by facts. "In most fishes whose males are differentiated by marked secondary characters, so far as is known, the male is larger than the female." Dr. T. Gill. Bull. Bur. Fisheries, U. S. A., Vol. XXVIII, 1908, page 1062 et seq.

[2] Salmon eggs = 5 mm. The largest pelagic eggs are that of the plaice = 1·65 to 1·95 mm.

[3] Pelagic eggs are always non-adhesive and free (Camb. Nat. Hist., page 412.)

[4] February is one of the coolest months in Ceylon: May the hottest up to 25th when the rains are due.

Days after hatching.	*Total length.*	*Principal events.*
1	3·5 mm.	Yolk-sac circulation established: pigment cells develop their black colouration: pigment begins to appear in eyes.
2 & 3	4·5 to 5 mm.	Pectoral fins arise : mouth opens and respiratory movements commence.
4	6·75 mm.	Larvæ leaving the surface and swimming freely at all levels.
7	7 mm.	Larvæ swimming and turning in unison at the slightest concussion. Caudal cartilages appear.
12 & 15	6·75 mm.	Posterior end of notochord bends up.
28	8 to 10 mm.	Caudal rays jointed and articulated with the basal cartilages. Larvæ rise to the surface to take air.
37	10 mm.	Primordia of dorsal and anal rays.
40	10·25 to 13 mm.	Rudiments of central fins appear. Dorsal and anal fins separating from caudal.
63	17 mm.	The fry now hide in the mud.
73	25 mm.	

The yolk-sac is absorbed and the fish get on the feed on the fifth day after hatching.

Here then is a fish which, as Dr. Willey rightly concludes, " could be reared with comparative ease in protected ponds and could be distributed subsequently as required. " It is prolific : extraordinarily hardy : adaptable in its habits to extremes of climate : very good to eat : easily brought fresh to market: and finally by no means contemptible as a sporting fish.

There is a tardy but distinct tendency nowadays to recognise the responsibility of Government with regard to the maintenance and replenishment of the stock of food fishes. And sportsmen will be doing a service not only to their " brethren of the angle " but to the public generally if they will collect and record *data* as to the breeding habits, not only of Ophiocephaloid but of all useful fish.

Even Dr. Willey's invaluable paper does not answer all the questions which a fish culturist would ask before undertaking to stock waters with *Ophiocephalus striatus* : and this point is easily illustrated.

The species is plainly adapted for pond culture. That is, pairs of fish should be turned into breeding ponds at the beginning of the spawning season and left to nest as in a state of nature. Ponds must be supplied at the shallow edges with reeds in which the " small rounded clearings" forming the nests may be cleared. Bushes for shade : " other aquatic plants " whose " small leaves " are used apparently for purposes of concealment of the floating ova : tussocks of grass to conceal and shade the young fish : all these forms of plant life are evidently essential in order to supply suitable spawning conditions. Dr. Willey does not tell us what plants he found round his nests and the first point to emphasize is the necessity for discovering these. Species would vary no doubt in different parts of India. But native fishermen sometimes possess considerably more extensive and more accurate knowledge of these matters than is generally accredited to them, and with proper co-operation *data* applicable to any district in India should be easily obtainable.

Secondly, as to the spawning period. We know that spawn is obtainable in Ceylon in February, May and June, that is just before the beginning of and throughout the Ceylon hot weather. How far do these periods vary in the different parts of the Indiar Empire ?

Thirdly, the male guards his nest and eggs for some time and is known to develop subsequently cannibalistic tendencies. What are the chief enemies which threaten the spawn, larvæ and fry? At what period does the parent drop the *role*[1] of protector and develop that of destroyer ?

Fourthly. The spawning habits of the American basses are in some respects analogous to those of the "murral". It has long been customary in the United States to protect the bass, nest with "a light cylindrical "frame of iron covered with cheese cloth, one end of which protrudes "above the water. This prevents the young fishes from wandering away "from the nest and makes it possible for them to be removed to nursery "ponds with the dip net,"[2] where they are safe from all enemies including the voracious parents. How can similar precautions be taken in the case of "murral"? Here is obviously a fine field for experiment by sportsmen and naturalists all over India.

Fifthly, how many pairs of "murral" should be turned down to breed in (say) one acre of water under ordinary conditions ?

Sixthly. Can the ova be handled and transferred before they reach the larval stage ?

Seventhly, or is it more economical to stock by transferring young fish ?

Eighthly, if so is it better to put them into the waters in which they are to remain immediately after the absorption of the umbilical sac? Or at some later period ? On this point Dr. Willey records that on the seventh day thirty of his "surface hatchlings" were eaten up by older fry of an allied species. This indicates clearly the necessity for adequate protection during the helpless period when the fish are suspended at the surface by their buoyant sacs. And it will be particularly interesting to ascertain whether parental care continues up to and beyond this time of extreme danger. Our author has described the feeding of murral fry with mosquito eggs and larvæ. Fishes of the seventh day would not touch the culicine egg rafts but would take detached eggs, and also the "minute larvæ" as they hatched out. For practical purposes outside of aquaria however it would be impossible to depend on a sufficient supply of culicine larvæ to feed large quantities of fish. And if artificial feeding were resorted to, as it would be in nursery ponds, some other form of food would no doubt be efficacious. Finally, what has been done for *Ophiocephalus striatus* should be done for all the other Ophiocephalids, and for all valuable food fishes. Dr. Willey's method should as far as possible be followed. The local poacher *par excellence* in India if properly handled will generally produce much valuable information. If this is followed up whether with Dr. Willey's thoroughness by daily observations in aquaria, or by observations in the field aided by a water glass "knowledge of the breeding habits of fishes under natural conditions," knowledge which Dr. Willey rightly describes as fundamental to economical and sound methods of culture, will soon be collected. A passage occurs in a report by an eminent official writer on Indian fisheries which would no doubt interest Dr. Willey and should be useful in the light of his paper to naturalists in Bengal. He writes :—"The second method (of propagation) "is only found in the suburbs of Calcutta and in the neighbouring districts

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[1] Thomas says "till about 2″ long." Rod in India. Chapt. XXIII.

[2] The Cultivation of Fishes in Natural and Artificial Ponds. Charles Huskins Townsend, Sc. D., Eleventh Annual Report, New York Zoological Society.

“of 24 Parganas, Howrah and Hooghly. The impregnated eggs float in small lumps near the shallow edges of rivers and are collected in a piece of cloth by certain low caste people and also by fishermen. They are bought by the rearers at the rate of Rs. 5 to Rs. 8 for a handful and put in shallow ponds where they hatch in a few days. *In about a month's time it becomes possible to distinguish the various kinds.* The fry are then caught with fine nets, sorted and put in different tanks: at the same time some are disposed of to hawkers who carry them about for sale to stockers of tanks. Eggs and spawn are largely caught in the Hooghly from above Cossipore and in the Rupnarayan, Amta in Howrah being considered one of the largest centres.”[*]

It is unfortunate that the report should have omitted to name the species dealt with in this manner: but the sentence italicised shows that Bengali fishermen know of more than one species which produces floating spawn. And should this paper meet the eye of the Commissioner of Fisheries, Bengal, or of the authorities of the Calcutta Museum, we shall no doubt be told the names of the species indicated, whether their eggs float of their own buoyancy or otherwise and other details. Meantime the methods described strike a fish culturist as wasteful and crude. For spawn floating down rivers must be subject to the attacks of innumerable enemies from whom it would be easy to protect it at inconsiderable expense in such a way as to double (at least) the percentage of successful hatchings.

Undoubtedly however there exists in India an ancient and deeply rooted love of fish culture. This, as Dr. Day and Mr. Thomas pointed out to deaf ears many years ago, only needs direction and encouragement along simple lines to solve the question of the exhaustion of inland fisheries. It is not too late. And Government is apparently at length awake to the necessities of the situation. May it never forget that the success of its efforts will depend on “knowledge of the breeding habits of fishes under natural conditions,” and that such knowledge will be available to all anglers who will cultivate the good will of the professional fishermen. It is perhaps not too much to hope that time will see the establishment of some central office which will collect, sift and diffuse in popular form the *data* collected for it by the many good naturalists who explore the waters of the Empire.

G. C. L. HOWELL, F.Z.S.

GURDASPUR, 30*th April* 1913.

Since the above was written (I understand) Mr. H. C. Wilson, Piscicultural Expert to the Madras Government, has carefully investigated the breeding habits of *Ophiocephalus punctatus* at the Sankesula Fish Farm. Those interested in Natural History in India will look forward with interest to an account from the pen of this able naturalist.

G. C. L. H.

No. XXVII.—NOTES ON THE HABITS OF SOME COMMON BUTTERFLIES, ETC.

As it appears from the article on Butterflies in Vol. XXII, Part I of the Journal that the habits of some species mentioned have not yet been recorded, the following notes may be of interest.

Pieris brassicæ nepalensis.—Many larvæ closely resembling those of *P. brassicæ*—though like the butterfly averaging I should say a little larger than the English form—were noticed by me on cauliflower plants at Peshawar and Bannu.

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[*] K. G. Gupta, I.C.S. Bengal Report No. 39. Revenue Department, dated 20th February, 1907. Calcutta 1908, para. 101 (obtainable from Messrs. Constable & Co, 10. Orange Street, Leicester Square, W.C.)

Pieris canidia.—Abundant at Peshawar, common also at Bannu and Mussoorie, seems out here to largely take the place of the small cabbage white—*P. rapæ*—at home, but the flight of *canidia* is more rapid, particularly if the butterfly is alarmed, and more graceful than that of the 'cabbage whites.' It is I consider a very graceful butterfly.

The female of *canidia* may often be seen hovering quite close to the ground, around a small low growing plant, presumably ovipositing.

Noticing the small size of many females of *canidia* both at Naini Tal and Peshawar and measuring 20 consecutive captures of each sex I found the average expanse to be—

Male 56·4 m.m. Female 53·1 m.m.

Two males taken on one day measured 41 m.m. and 61 m.m., one being under and the other over the limits given by Col. Bingham. What is the reason for females of *canidia* in the N. W. of India so often being smaller than males, for a friend tells me this is not the case among specimens examined by him from further East?

Synchloe lucilla.—This pretty little butterfly is common on the N. W. Frontier in early spring, about rough stony undulating ground with small scattered bushes, and owing to its size and markings escapes notice until it is close. I have secured a number of good specimens by knocking them over with a stick, for want of a net, though the loose stones and uneven nature of the ground coupled with the erratic flight of the butterfly sometimes make the chase difficult. It has an obliging way, when much harrassed, of settling for a moment or two on the ground or on a leaf as some *colias* occasionally do and so affords an opportunity of covering it with the net. The green underside—deeper green in the female—assists concealment of the butterfly among the yellowish green leaves of the little bushes so common where it occurs.

Neope (Lethe) pulaha and *Hestina nama* both exhibit such attachment to a particular spot that they will often allow repeated attempts at capture, until, becoming too occupied with some rival, they are taken easily on the wing.

A *Sephisa dichroa,* settled about 20 feet up on an oak-tree, allowed me to throw handfuls of shale and stones over it from below without its leaving the tree. Sometimes it would remain on the leaf in spite of the stones showering on and around it, or it would fly up towards a passing stone; until after about half an hour of this, its hind wings much torn by the stones, it came down lower and was captured. Leech gives a very similar account under this genus in his "Butterflies of China."

On a bright sunny day early last spring I saw a small bat flying at noon close above me about a stream, evidently enjoying the sunshine. It settled on a tree and flew off when I was about 10 feet away and soon settled again somewhere about the bank overhanging the stream.

When after butterflies one day in Surrey not long ago, on scraping some sand I came upon a good specimen of a paleolithic flint instrument and an unexpended Lee-Metford (blank) cartridge, two curious companions!

H. D. PEILE, MAJOR, I.M.S.

MUSSOORIE, 21*st May* 1913.

XXVIII.—NOTE CONCERNING *ZEPHYRUS ATAXUS.*

In the Murree Hills *Zephyrus ataxus* appeared last year (1912) about June 21st, and from that date to the end of June was out in considerable numbers. I only found it in the thickly wooded valleys which go down to the Jhelum at a height of about 4,500 to 5,000 feet. It is a shade loving butterfly and seems to spend most of its time sitting on the branches of a shrub which has been kindly identified by Colonel Bamber as *Sarcocca pruniformis* of the Euphorbiaceæ (see Journ. B. N. H. S., Vol. XIX, page 959). This shrub grows in great quantities along the sides of the nullahs, being in some places the only undergrowth under large trees. When *Zephyrus ataxus* was not sitting on the above shrub it was usually sitting on the shady sides of large rocks in as dark a place as possible in company with *Euaspa milionia*, which was also to be found there in large numbers. *Zephyrus ataxus* was difficult to distinguish against its background in the shade, but once seen was easy to capture, as it would sit still with the greatest patience. One day my wife and I caught seventy within a space of one or two hundred yards square.

June 30th was the last day I went down to that valley just then, so I am unable to say how long they remain out; but I found one worn and battered ♀ at the same height on 21st September after the rain had stopped.

C. W. WATNEY, CAPTAIN,
S. and T. Corps.

PESHAWAR, 3rd *March* 1913.

No. XXIX.—NOTE ON *ZEPHYRUS ZIHA*.

Last year (1912) I took 5 specimens of *Zephyrus ziha* in the Murree Hills at heights of 6,000 to 5,000 feet. "Murree Hills" should therefore be added to the list of localities given for this butterfly by Captain Evans in his List of Indian Butterflies, Vol. XIX, p. 988.

C. W. WATNEY, CAPTAIN,
S. and T. Corps.

PESHAWAR, 3rd *March* 1913.

No. XXX.—MIMICRY IN SILKWORM MOTHS.

With reference to the article in the last Number of the Journal on the serpent-like apices possessed by some moths—and the case of an owl's face being simulated—it may be interesting to turn to a letter by E. H. Aitken in Vol. XVI, No. 1 (1904), headed "The Enemies of Butterflies." In this "Eha" is speaking certainly of butterflies alone, but it seems probable that the protective resemblance to a snake's head shown by the wings of some of the Atlas Moths may be not so much a guard against birds as lizards. A lizard will not walk into the jaws of a snake, if he can help it, and he certainly will not try conclusions with an owl. I make the suggestion with all reticence and stand open to correction; but from the comparative number of (*a*) lizards, (*b*) birds, found in the stomachs of snakes would one not infer that for one bird scared, a good many lizards would be driven off. And again it would be a bird of some size that would tackle an Atlas Moth anyway, whereas one knows well what an extraordinary large moth or insect even the little wall gecko will go for.

C. BEADON.

TAVOY, L. BURMA,
21st *May* 1913.

No. XXXI.—ON THE LIFE HISTORY OF *COPTOSOMA CRIBRARIA, FABR.*

This Pentatomid bug is one of the commonest insects found attacking *Dolichos lablab*. It does not however confine its ravages to this plant alone it has been found to infest agathi, red gram, indigo and cluster bean plants also. The insect enjoys a wide distribution, and it has been noted in several districts in the Madras Presidency.

Life History.—The whole life history of the bug from egg to imago is spent on the plant itself. As is usual in bugs, coupling takes place in opposition. This process was noted in some cases and found to occupy a period ranging from 50 to 70 minutes.

Egg.—In from 4 to 7 hours after union, egg-laying takes place. After coupling, the female crawls about the tender shoots and leaves evidently on the search for a suitable spot to deposit the eggs; they are generally laid on the leaf-surface but they are also often found on the tender stems and the beans. One bug lays from 10 to 40 eggs, the commonest number being 35. The eggs are laid invariably in two parallel rows arranged back to back. Each egg when laid is cemented to the plant surface by a sticky fluid secreted by the bug. The eggs are very soft on being laid, but soon harden when exposed to air. Each egg is a tubular object measuring $\frac{2}{3}$ m.m. along its long axis. In colour it is creamy white showing iridescent colours in certain lights. That end of an egg which is away from the adjacent parallel row is circular and has a toothed rim; it is covered up by a circular lid-like structure. The long axis is faintly sculptured and granular. The eggs hatch on the sixth day after being laid. As the hatching time approaches the egg group appears darker in colour. Just before hatching the lid at the end of the egg shell is pushed open from inside and the young insect slowly emerges out along the passage made. The young nymph takes a long time to extricate itself completely from the egg shell. The lid when open remains like a door on its hinge. (*See* Plate B.)

1*st Instar.*—The just-hatched nymph is a tiny oval object, having a shining orange colour. From head to the tail end it measures $\frac{3}{4}$ m.m. and across the body transversely $\frac{1}{2}$ m.m. The antennæ are fairly long: the small eyes are bright red. The dorsal and lateral portions of the body are hairy, being covered by short setæ. The insect at this stage is not active, a number of them remaining gregariously at one spot. Owing to its minute size the insect is easily overlooked at this stage. (*See* Plate B.)

2*nd Instar.*—The period of the first stage occupies 8 days, at the end of which the first moult takes place. The insect now measures $1\frac{1}{8}$ m.m. long and has a pale brownish colour. The body is as before hairy with setæ. The wing rudiments appear as very faint dark spots. The mid-dorsal region of the abdomen has a pinkish patch (probably the beginnings of the stink glands). The eyes turn paler from their original bright red colour.

3*rd Instar.*—Six days after the first moult the insect casts its skin for the second time and gives rise to the third instar. The nymph is now decidedly bigger, being $2\frac{1}{8}$ m.m. long. The colour becomes pale-green. The wing pads appear clearer and of a darker green than before. The pinkish patch on the mid-dorsal region of the abdomen now appears as two or three small oblong patches.

4*th Instar.*—The third instar lasts 9 days, after which the 3rd moult takes place. The insect now measures $2\frac{3}{4}$ m.m. The body is light whitish-green in colour. The wing pads form dark olive patches slightly lengthened backwards. The setæ around the abdomen on the lateral plates (?) are brownish green. Body and head hairy. Two small black spots are found on the middorsum of the abdomen.

5*th Instar.*—Another 9 days pass and the skin is cast by the nymph for the fourth time. This is the last stage in the nymphal period of the life of the bug. It is now 4 m.m. long. The body is oval in shape and slightly convex above. Antennæ fairly long and setose. Colour of head and thorax olive-green. Abdomen greenish; wing-rudiments dark; the region corresponding to the wing pads on the ventral side of the body is also dark. The spines on the lateral edges of the abdomen are borne in groups on light-green patches (plates). The ventral side of the abdomen is greyish-fuscous. The two black spots on the middorsum of the abdomen appear clear. The proboscis extends a little beyond the second pair of legs. In ten days more the insect sheds its skin for the last time and assumes the adult stage. (*See* Plate B.)

Nymphal habits. – In the first two stages in the nymphal period, being minute in size the creatures crawl about gregariously on the leaves and tender stems and easily escape detection. The later stages, especially the fourth and fifth instars, display their hiding habits remarkably. During these periods they are almost always found hiding under cover of the small stipules or leaflets found at the junction of one stem with another or at the nodes. Their colour is also so similar to that of these structures, that the nymphs appear very well-hidden in such situations. The younger nymphs often collect in a group on the undersurface of the short thick stalks of the tender leaves. Of all the stages the last instar is the most active and displays the habits of the adult to a great extent. It crawls along the tender vines and leaves and when touched or detected either drops down or crawls along the lower surface of the stem or leaf. The nymph in the different instars differs from the adult so much in external features that the immature bug is liable to be mistaken for an entirely different insect. The body of the nymph is more or less flat and clearly covered with hairs and setæ, while the adult has a smooth convex body and a pale ochraceous green colour. So far as observations in nature and in captivity were made, the nymphs have been found to remain on the plant only and not in soil. (Compare p. 672, Lefroy, *Ind. Ins. Life.*)

The whole life period of the insect from egg to imago occupies roughly a month and a half, the periods passed in the various stages being approximately as under:—

Egg	..	..	6 days.
1st Instar	..	..	8 „
2nd „	..	..	6 „
3rd „	..	..	9 „
4th „	..	..	9 „
5th „	..	..	10 „

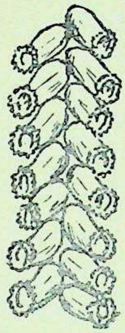
The adult was found to live in captivity for a week. Thus the life cycle of one generation extends roughly over a period of two months.

T. V. RAMAKRISHNA AIYAR,
Asst. in Entomology, Madras.

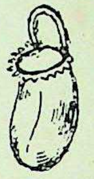
[*Coptosoma cribraria* is a common small green bug, about one-fifth of an inch in length and of a stout squat build, which is very liable to be mistaken for a beetle by a non-entomological eye. The species is described and figured in Vol. I, pages 22-23, of Mr. Distant's "Rhynchota" in the *Fauna of India* Series.—T.B.F.] (*See* Plate C.)

No. XXXII.—LARGE SWARMS OF BEES.

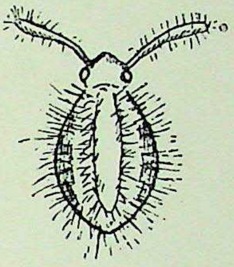
I send herewith a photograph (Plate A) of a peepul at Jullundur which has 21 swarms of wild bees on it, the largest being six feet long and thirty inches in depth. There were 19 swarms on the same tree last year, probably on account of its being near several large gardens. The photo was



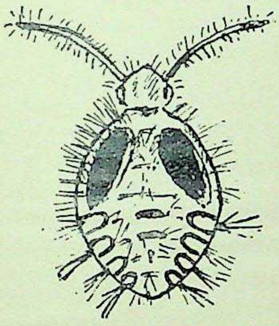
A batch of eggs of *Captosoma* (enlarged).



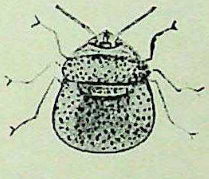
One eggshell showing open lid (enlarged).



1st Instar (enlarged).

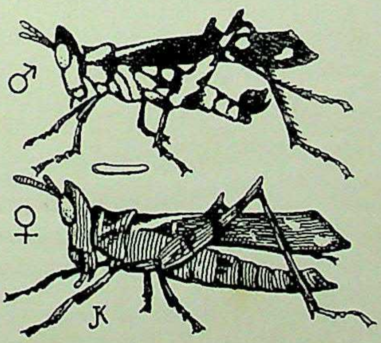


5th Instar (enlarged).



Perfect insect.

Life history of *Coptosoma cribraria*, Fabr.



Mastax sp. from Macao, China, male, female and egg.

taken on the 21st April, the peepul being bare of leaves at this season for about a fortnight. The bees were *Apis indica.*

H. FOOKS, LT.-COL., I.M.S.

JULLUNDUR, PUNJAB,
25th April 1913.

No. XXXIII.—ANT-MIMICRY BY A *FORMICOMUS* (*COLEOPT., ANTHICIDÆ*).

One evening about the end of July 1912, I noticed a small ant swarming from its nest below ground under a grass lawn at Coimbatore. For some days previously there had been heavy rain and the ants were probably busy in clearing out their galleries after the wet weather. There were no winged individuals amongst them and the workers seemed to be doing very little excavation-work, but were pouring in and out of the three or four entrances to the nest (mere holes in the ground, without any embankment of any sort) and were running about over the adjacent ground in an apparently aimless but excited manner. At such times myrmecophilous beetles may sometimes emerge from the nest and I therefore looked to see if I could find any. Sure enough, several small beetles were soon found to be present. They were running about over the ground intermingled with the ants, which in life they mimicked so exactly that (particularly as dusk began to fall) I caught an ant in mistake for a beetle, and *vice versa* on several occasions. The beetles did not seem to be in any way pets of the ants. Generally they took little notice of one another and, if an ant and a bettle met, they usually avoided one another mutually, but occasionally the ant attacked the beetle and both rolled over and over in a rough-and-tumble struggle which always ended by the ant letting go its hold and running off in precipitate retreat. It seemed to me (though I could neither see, smell, nor hear the explosion) that the beetle, when thus attacked, discharged some volatile liquid highly disagreeable to the ant.

I could not see a beetle emerge from the nest nor enter, and those I caught and dropped into the entrances were at once expelled. But the beetles were so common amongst the ants—and only on that area where these ants were swarming; I could find none on other parts of the lawn beyond the radius of this particular ants' wanderings—and mimicked the ants so exactly that I supposed there must be really some association between them.

Father E. Wasmann, S.J., has kindly examined these beetles and writes that they belong to the family *Anthicidæ* genus, *Formicomus,* and has returned a few specimens labelled *F. indicus,* Wasm MS., the species being undescribed and the name as yet unpublished. He says further: "You are right in supposing that there is no friendly relation between these beetles and the ants. The species of *Formicomus* live in the *neighbourhood* of ants-nests, probably devouring isolated ants. The ant-mimicry in these beetles is very high." The ant is *Monomorium salomonis indicum,* Forel, a common species in India.

Probably readers of the *Journal,* who will observe ants when they are swarming, may find this and probably several other quite new cases of beetles which mimic ants and live either with them or on them.

T. BAINBRIGGE FLETCHER.

COIMBATORE,
18*th February* 1913.

No. XXXIV.—LIFE-HISTORY OF EUMASTAX, sp.

Dr. David Sharp, in the Cambridge Nat. Hist., Insecta, Pt. I, p. 301, says of the tribe *Mastacides* of the Family *Acridiidæ* that nothing seemed to be known at that time (1901) of their habits or development. In 1906-7, therefore, since a sp. of *Mastax* or *Eumastax* was common near Macao in South China, I worked out the life-history and sent the paper and figures to Dr. Sharp, but unfortunately it was lost. I have recently found some of the principal rough notes from which the paper was written, and send the following brief account, as I believe very little is even yet known of the habits of these insects.

This species is usually very common but exceedingly local near Macao, and is only abundant in a small patch of wood at Pak-sa-liang village. It is not found except in wooded districts, and appears to browse entirely on shrubs and woody plants; I have never seen it feed on grasses. One of the favourite food-plants is *Paretta indica,* L., N. O. *Rubiaceæ.* The males much outnumber the females, and are very brilliantly coloured with vivid yellow-green and two spots of blue-green on one of the abdominal segments. There are a few hyaline spots in the wing and one spot of green. The general ground colour is very dark brown and black, the tegmina being black. The female is larger than the male, and sombrely coloured with various shades of brown and dusky black. The parts left white on the figure of the male are chiefly bright, almost metallic, green. The few spots left white on the figure of the female are dull ochreous. (*See* Plate C.)

Eggs were laid on September 14th, 1906. They are slightly curved, smooth, rather shiny and of a darkish yellow.* They are deposited in small batches in the ground in the usual manner, except that very little collateral fluid is used, though the eggs are slightly cemented together. One pair of the insects remained in copula about three hours in the early morning, and the eggs were laid in the afternoon. The first nymphs hatched out on the morning of April 8th, 1907.

Summary of life-history :—

Eggs laid,	September	14,	1906.	
,, hatched,	April	8,	1907.	
1st moult,	May	26	,,	
2nd ,,	June	6	,,	
3rd ,,	,,	21	,,	
4th ,,	July	5	,,	
5th ,,	,,	24	,,	
6th ,,	August	20	,,	to adult.

After the final moult the male takes about five days to arrive at full adult colouring, passing through various brown and ochreous colouring before the green tints become gradually visible.

From these few notes it will be seen that there is nothing special about the development of this insect, except that the eggs seem to be deposited in a careless and rough manner, with very little protection from collateral matter, no real covering over the egg-batch being formed. The batches seem to always contain few eggs, and there is but one brood a year; about the beginning of November all the *Mastax* seem to have died off. The females appear to live about a month longer than the males. There are periods of really cold weather in S. China from November to March, and this is also the dry season.

The great difference of colouration between the sexes is unusual in the *Acridiidæ.*

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* The eggs are large compared to the size of the insect.

In S. China, where I observed them several years, these insects never increased noticeably in any season; they are slow breeders and their eggs are probably often destroyed. They are also somewhat restricted in their food, and exposed in their habit of sitting on leaves of shrubs, and are inactive compared to most of the *Acridiidæ*. In countries like China where every form of woody vegetation is cut for fuel; it is probable that the *Mastacides* are rapidly diminishing in numbers, and their place taken by other forms of *Acridiidæ* which can better adapt themselves to altered conditions of life. I much regret having done no anatomical work on the *Mastacides* when I had plenty of material: they appear to me to be a very ancient form of the *Acridiidæ*.

J. C. KERSHAW.

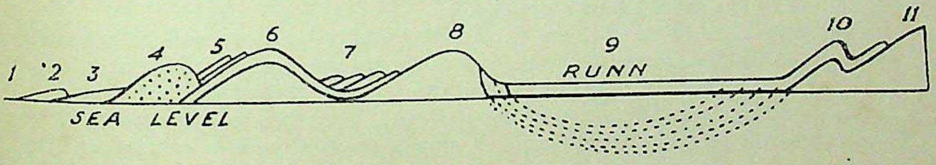
TRINIDAD, B.W.I.,
7th January 1913.

No. XXXV.—NOTES ON THE CUTCH AMMONITES.

IV.

THE LER-HAMUNDRA ELLIPSE.

After digressing to Keera on the S. edge of the Great Runn I return to the line of the Charwar Fault. While calling it a fault in obedience to Blanford and Wynne, one cannot help having a secret desire that it may not be a fault so much as a crumple. I know it is heresy to say so, and I am prepared for the stake: but the fascination lies in this, that if it is a crumple, the whole scheme of Cutch simplifies itself into three crumples, caused I suppose by the drift or suction of land towards the North. The following sketch would represent a section from Putchum Island due South:—

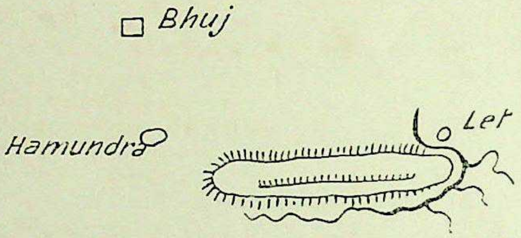


1. Gulf of Cutch.
2. Alluvium.
3. Tertiary.
4. Trap—of Cretaceous Era.
5. Cretaceous and highest Jurassics.
6. Jurassics (Kimeridge, Oxford and Callovian).
7. Highest Jurassics, Plain of Bhuj.
8. Jooria Hills (Kim., Oxf. Callov.)
9. Runn—overlying out-crops of Jurc. (Kim., Oxf. and Up-Callov.).
10. Putchum: Gora Donger, Low-Callov. and Bath.
11. Putchum: Kala Donger, Bathonian.

The question at present is this:—Is No. 6, the Katrol-Charwar range, faulted or not along its N. side: or does it curve under No. 7, the Bhuj plain. As said before, the N. scarp of the 'Vanguard' hills of the Fakirwadi section looks as if faulted: there is no sign of any N. slope of an anticline. But in many other parts of the range—Samatra, Bharasar, parts of Fakirwadi, and the Ler-Hamundra section, the last that one sees of the range of hills before one gets down on to the Bhuj plain, is the N. slope of an anticline, with E. and W. axis. Hence though faulted in parts by extra strong folding or crushing, I am inclined to believe that the beds of No. 6 do curve under No. 7, to reappear at 8 (the Jooria-

Habye-Keera line). From 8 the beds do undoubtedly curve down; and though it seems that their next rise and out-crops is covered by the Runn, yet the beds below them are found in Putchum Island. The highest (latest) beds of Putchum are as a fact the same as the lowest beds of Keera (see Waagen's note on *Steph. grantanum*) : and the northerly out-crop in Putchum (No. 11) shows the lowest and earliest Cutch beds. But after all to fight over the question of No. 6 being faulted or curved is not so very interesting, and I dare say I am wrong.

Ler lies 7 miles S.-E. of Bhuj at the foot of the Charwar Hills. Hamundra is a tank 3½ miles S. of Bhuj at the foot of the same hills. The distance from Ler to Hamundra is 5 miles. As 1½ miles E.S.E. of Hamundra the great Ellipse begins. Its length is 3½ miles: its breadth across the middle about 1½. Its ends off in a fine curve of hills steeply dipping outward, just S. of Ler village ; a nulla and broad valley separate it off from the wider moss of hills behind, so that it forms a complete unit. The backbone of the Ellipse is a range of ridges, flat topped or slightly domed, perhaps 300 feet above the plain, set a bit south of the long diameter, their crest and slope to the North being eroded.



The South side of the Ellipse can fairly quickly be dismissed: it is a fairly steep slope of S. dipped hills running down to the nullah. The nullah bed first drains the white grey shales of the higher Katrol beds: soon it is found flowing over the smooth floor of the hard brown pavement of the lower Katrol. Presently it has cut down to the yellow crimson pitted pavement of Dhosa Oolite with its swarms of Belemnites and other Molluscs standing out in relief. Further west it reaches Athleta beds, and leaves a cliff on its right of D. O., and, over it, Katrol. On gaining Anceps beds, it scours the soft shale well out, and the cliff on the right shows a good exposure of the white muddy shales and big white nodules of the *Athletas*, below the D. O. belt. And on this Anceps floor it sweeps round the curve to Ler, leaving the Sub-Anceps or "Vanguard" hard brown sheets upstanding on its left. The beds of Katrol, D. O. and Athleta curve round too on the right and run up in a tongue to Ler: but their back only dips down slightly to the east, soon rising again to form the back of another Ellipse which starts just beyond Ler and runs east. Besides being an excellent means of following out the succession of strata, the nulla is a perfect mine of fossils. The characteristic fossils of the Katrol beds—*torquatus, katrolensis, bathyplocus, chloroolithicus,* &c.—stand out in relief on the hard brown rocks. Thorny *Aspidoceras* and worn *Stephanoceras* may be found amid the mollusc swarms of the D. O. slabs: while lower down, there is a regular jumble of all sorts: big ironstone Katrol specimens, D. O. *Belemnites, Athleta Harpoceras, Anceps Omphalodes,* and large plate-shaped Ammonites of the Vanguard slabs—like *Paramorphus* or *Congener*. In such a medley a new fossil's origin cannot easily be traced. One fragment of a huge Oppelia has a whorl of the following dimensions:—height 97 mm., height from preceding whorl 60: breadth 41: with a series of 8 lobes visible from siphon to umbilical edge; but I cannot say from which bed it came. So with some others. Katrol beds have produced three specimens of what looks like *Phylloceras mediterraneum*, of which Waagen says:—" In Europe this species has a very large vertical distribution and ranges from the Bathonian to the uppermost Jurassic group: not so in Kachh, where it seems to be limited to upper Callovian beds" (Athleta). My specimens from Katrol beds (Kimeridge) agree very closely with Dr. Waagen's description except that the second lateral lobe is almost as long as the first: and in the one specimen which is almost (*ad hoc*) complete there are 6 furrows to the half whorl.

The hills at the east end of the Ellipse—inside the nullah bend—are of the Sub-Anceps or "Vanguard" type, hard crimson brown rock in great sheets. At one place they hold a swarm of small white *Trigoniae*: in other slabs some big Ammonites like *Paramorphus* or *Congener* can be found: they seem like some of the numerous plate-shaped fossils of Belt 6 (Sub-Anceps) of Keera, but the 1st lateral lobe prevents their being *Paramorphus*, nor do they quite agree with *Congener*.

The hills at the west end also curve (or nose) round in the same way, but are more difficult to trace, nullahs having broken through westwards and left much debris. At this end, a high point on the south side shows a protruding ridge of rock, which can be traced for some distance W., gradually sinking. This belt is of D. O., and the rocks capping it are of the Katrol beds, of the black-grey quartz-speckled variety. The slope below the D. O. is of Anceps with many *Terebratula biplicata?* a few *Anceps* fragments, *Rhynconellae* and other Molluscs common to Anceps beds.

The north side of the Ellipse varies. For some distance at each end (E. and W.) we have the outer rocks all dipping very steeply N. Towards the west, the relics of this wall are seen in four great humps, at the top of which Katrol beds, with fragments of *Per. torquatus*, lie; a bit lower on their inner face (S), the D. O. belt crops out; and below it the crimson and white Anceps beds. On the similar hills at the east end (N. side) the Katrol, D. O. and Anceps beds have been worn down almost to the level of the Bhuj plain, the high upstanding hill being of Vanguard or Sub-Anceps type.

But for about a mile in the middle, we find that the outermost rocks (N.) are dipping S., leaving a scarp exposed to the north. This seems to be due to a secondary anticline, pushed up by the mass of hills behind and faulted, or more probably sea worn, for by following out the top of this ridge eastwards, a complete anticline, running parallel with the main anticline, is observed. A. N. and S. section of the east and west ends, and of the middle appear thus:—

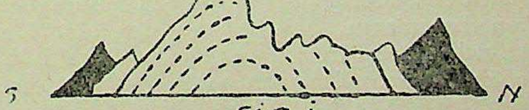


Fig i.

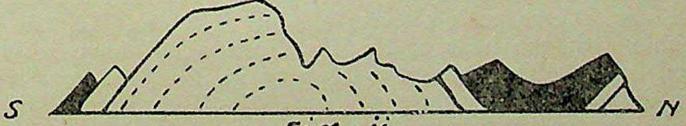


Fig ii

The N. syncline shown in Fig. ii is very conspicuous at a point S. of the village Bajodi. Here the Dhosa Oolite and the superjacent red Katrol beds come to an end in the form of the end of a paper boat with steeply inwardly-dipping sides; and 200 yards from its upstanding curved end rises a biggish cone of Katrol beds, just like the "mast" of a paper boat—a similar but much wider basin appears at the west end of the syncline.

The D. O. along this syncline is very hard and tough: few Ammonites have weathered out, but I have found what I believe to be *Pelt. arduennense*, *Per. rota*, and *Asp. babeanum*, all known to be natives of D. O. seas. The Athleta beds are here covered up with debris: but an *Athleta* fragment was found on its expected level. Fragments of *Per. anceps* and *Per. obtusicosta* were picked up on the Anceps beds.

So far I have described the outer shell of the Ellipse. Now for the kernel, which is interesting. The west end of the Ellipse shows the subjacent beds best, for there I have found the best-preserved fossils.

From under the ordinary Anceps beds, there emerges a great sheet of hard brown Vanguard rock, running up to a crest. (Sub-Anceps 1): next a mass of cold crimson shale, much like proper Anceps (Sub-Anceps 2): below that another flat expanse of slab rock (Sub-Anceps 3), much like Sub-Anceps 1.; and below that nothing but weather-blackened cold grey sandstone, in places impregnated with lime, to a considerable depth. Sub-Anceps 1 is not a good fossil field: at the east end I have found some small white *Trigoniæ*: also the large plate-shaped *Congener*? or *Paramorphus*? In the shales, Sub-Anceps 2, a long hunt only unearthed two small broken *Harp. crassefalcatum* (?).

In Sub-Anceps 3 a fairly good crop was gathered:—fragments of *Steph. fissum*; *Steph. opis*; *Perisph. Perdagatus*, *Balinensis* and one like *Congener*; *Naut. calloviensis*; and others that might be *Perdagatus* and *Fissum* except for lobes. Now these finds show the similarity of these beds to the highest Sub-Anceps beds at Keera: but *there* the rock is of light yellow-brown: *here* it is of dark crimson-brown. Nearly all the specimens found in these Sub-Anceps beds here have brothers in the Keera highest Sub-Anceps or top-Macrocephalus beds. At the east end on a long transverse ridge running up to the highest cone, these lower Sub-Anceps beds—there of a coarse yellow-grey—contain worn fragments of what was not improbably *Per. altiplicatus*, another Macrocephalus-bed fossil: and also a *Bel. sub-hastatus* which. Waagen confines to Macrocephalus beds.

Thus far down these Sub-Anceps beds here seem to agree with the outer Macrocephalus ring of Keera. But here comes the rub. At Keera below this outer ring, comes the inner, lower, ring of crowded molluscs and of corals: then thick belts of golden oolite; and then yellow and purple shales, all stocked full of Ammonites, chiefly *Stephanoceras*. Here on the other hand below the Sub-Anceps bed, we get nothing but the cold grey weather-blackened sandstone, without the sign of a fossil. Black, grey and grim these beds extend from east to west of the Ellipse, forming the whole kernel of the range. They dip conformably, it seems, with the dip of the shell, but I am not satisfied about this. The mass it is impossible to describe without instruments. Roughly there seems to be a series of concentric semi-circles, thrown out from the main backbone ridge like onions with peeling layers, curving ridge separated from ridge by deep hollows. Three such onions take up 2 miles. If the beds are conformable with the beds of the shell, one would have looked for the same beds as at Keera where conformity is clear; whereas the actual beds are so essentially different from the Keera ones. If they are conformable, one must seek for the explanation of the difference of the sub-beds of this anticline from those of the parallel (15 miles north) anticline of Keera and Jooria in the theory of deep and shallow water having existed in the two latitudes.

Anyhow you could not want a better hunting ground for the Cutch upper Callovian, Oxfordian and Kineridge fossils than is to be found in this Ellipse.

J. H. SMITH.

BHUJ, 20*th March* 1913.

(*Where Ammonites are named in the above, it should be understood that their identity is not yet established. They merely appear to Mr. F. H. Stone and myself to agree with those described and illustrated by Dr. Waagen.*)

No. XXXVI.—CUTCH AMMONITE BEDS.

Writers on Cutch Palæontology have followed Dr. Stoliczka's classification of beds. Summarized, it comes to this—

No. 0 Trap Rocks.

Umia ...	No. 1	with	Crioceras	...=Aptian ...	3,000 feet.
	,, 2	,,	Cycadaceæ	...=Barremian...	
	,, 3	,,	Per. eudichotomus ...	...=Neocomian...	
Katrol ...	No 4	,,	Phyll. ptychoicum ...	...=Kimeridge...	1.000 ,,
	,, 5	,,	Steph. maya	...=Sequanian...	
Charee ...	No. 6	,,	Asp. babeanum ...	...=Oxfordian...	50 ,,
	,, 7	,,	Pelt. athleta	...=Callovian ...	25 ,,
	,, 8	,,	Per. anceps	...=Callovian ...	1,000 ,,
	,, 9	,,	Steph. macrocephalum	...=Callovian ...	
Putchum...	No. 10	,,	Opp. serriger ...	...=Bathonian...	500 ,,
	,, 11	,,	Trigoniæ. Corbulæ, Cuculleæ	=Bathonian...	500 ,,

Mr. Vredenburg (Sum. Geo. Ind.) has given the above depths. What strikes one at first sight is the great disparity in the "Zoning": Why should Athleta beds of 25 feet have as great a standing as the 500 feet of No. 10. Probably with the modern recognition of more numerous zones, an expert could sub-divide several of these beds into more minute divisions. I should fancy from what I saw of it that the No. 9 bed as exposed at Kéera might well be found to consist of definite zones of various forms of Stephanoceras.

I do not know where the line between the Umia and the Katrol beds is drawn. Umia beds are classed as Cretaceous, Katrol as Jurassic. Waagen is of opinion that the higher beds which here lie under the stratified traps are cretaceous: but as yet the few cretaceous fossils found come only from Umia, some 50 miles W. N. W. of Bhuj. Now between No. 6 and No. 0 lies a very great depth of beds—mainly flaky shale below, and sandstone slabs and rock above. To cross this extent of Katrol and Umia beds, you drive 11 miles along the Bhuj-Mandvi road, pretty well at right angles to the strike ; and as you go the exposed rocks are all dipping—more or less—to the south : and the road is fairly level. The 6th milestone is just at the upper edge of Belt 6 : and the 17th marks the change to Belt No. 0. And Belt No. 5 does not exist here : so if you allow Belt 4,500 feet depth, the eleven miles carry you through only 3,500 feet of uptilted strata.

Descending from No. 4 to No. 9 the beds are mainly of shales with thin sheets of rock of various natures laminated among them. These harder beds serve to mark the distinctions of the lower Ammonite beds. Some kinds of Ammonites managed to struggle through from one bed to the next, but the majority of species are confined each to its own layer. The Katrol beds proper (No. 4) along the Charwar out-crop lie flat on the Dhosa Oolite (No. 6). [No. 5 is a local bed, and its claim to rank as intervening here was decided on palæontological grounds (Waagen p. 230). Anyhow it is absent in the western half of Cutch. Its chief appearances are noted at Kuntkote in N. E. Cutch and the Island of Gangta Bet in the Runn: it appears to be of a red sandstone.] The layers of Katrol rock are of a very hard red-brown sandstone; in places, a black grey with minute quartz pebbles. In one spot (N. W. of the tank on the Bhuj-Bharapur road) the layers succeed one another closely with hollows where the intervening shales have been washed flat. They seem to be here of a depth of about 300 feet. They contain very numerous specimens of *Per. torquatus, katrolensis, bathyplocus, Pottingeri, chloroolithicus*: also *Asp. Iphiceroides, binodiferum* and several of the Hybonote group (not supplied to Dr. Waagen); *Phyll. mediterraneum* (?), and others (not given by Waagen); *Opp. kachhensis, trachynota* and others, some being very big.

No. 6. (Dhosa Oolite) is a very marked and easily recognizable layer, quite distinct from the Katrol beds above and the Athleta and Anceps beds below. The main layer of rock is of a very hard crimson and yellow calcareous sandstone. It forms long ridges, often protruding distinctly from a hillside or from a plain. The underlying shales which complete the bed are of a yellowish grey. Where a stream has run along the back of D. O., it leaves the rock exposed in great sheets, pitted but very compact and unworkable. Big *Aspidoceras* (*perarmatum* and *babeanum*) and big *Stephanoceras* (*Transiens* and others) may be found protruding, but have to be abandoned because of the hardness of the rock. *Belemnites* and hosts of other molluscs swarm in the rocks. If anywhere you come across an angular cube of yellow green rock with a steely blue Belemnite inset, you may be pretty sure that D. O. is not far off. Even away from water, where wind and decay have swept clean the back of a sloping D. O. layer, you will find a great pavement of slabs with big Stephanoceras preserved in fairly good condition and more broken-up discs of large *Aspidoceras*. Judging from big fragments often picked up, some kinds of *Aspidoceras* must have been huge. At Bharasar where the ledge of D. O. protrudes from under the side of the Charwar hills, one can collect great numbers; being dry-weathered they come out of the rock much more easily than they do from a watercourse. Of other species, *Per. rota* is very common; some good *Phylloceras* can also be had, and not a few *Harpoceras*. One *Hecticum* (verified by Mr. Burton of Calcutta) was a welcome find. The 50 ft. assigned by Mr. Vredenburg fairly represents the average depth of the D. O. bed.

No. 7. (Athleta beds) has been estimated at 25 feet. In many parts of the Charwar line, the beds do not appear, but are perhaps only covered by debris. Where they occur in a nulla, they are of a white clay shale with layers of big rounded white nodules. In the Fakirwadi "Bowl" they seem to me to alternate for a bit with the crimson Anceps layers. At Samatra the prevailing tone of the beds is a golden colour or a greeny yellow; and perhaps there they are deeper than 25 feet; but it is not easy to draw the line of the beds. *Pelt. athleta* is found in this level only: even where the beds are apparently non-existent between D. O. and Anceps a fragment of *Athleta* may be found here and there. But the soft nature of the bed shale has left no full specimen of this kind findable. To find anything beyond the fragment of one whorl is rare. But other specimens are not so bad. Excellent *Harp. dynastes* and *lairense*, and fairly complete *Asp. ponderosum* are obtainable. The absence of *Stephanoceras* is to be marked. This family swarmed in *Macrocephalus* times and again in D. O., but it seems to have been in abeyance in Anceps and Athleta eras.

No. 8. Anceps beds. The matrix is of white, soft, often gypseous shale: seams of crimson iron nodulelets or cubes thread the shales, and the exposed surface is a mass of small crimson debris, soft to walk over. A similar belt also occurs in the shales above the Katrol brown rocks; so one cannot be sure of being on Anceps ground until one has noted the overlie of the D. O., or found 'Anceps' fossils. The thickness is not given: I should put it down as about 200 feet, varying of course. You can be pretty sure of picking up something nice in a belt of Anceps rock. *Perisp. omphalodes* is fairly common and in good preservation. *Perisph. obtusicosta* is not infrequent, but seldom complete. Waagen says *Per. anceps* is rare: but on the S. E. side of Keera Hill, they are fairly plentiful. Here too I found two pretty *Per. pseudorion*. *Phylloceras* of the *feddeni* type occur: also *Lytoceras adeloides*.

No. 9. Macrocephalus beds are best seen at Keera Hill, as recently described. The sub-Anceps beds in the Ler-Hamundra Ellipse (along Charwar) contain many specimens of the same species as are found in the upper Macrocephalus beds at Keera. *Steph. fissum* and *Opis*: *Perisph. Balinensis*, *Perdagatus*, &c.: so though the two beds have a different colour and structure, yet they belong to the same period. Waagen has divided the Keera beds roughly into golden oolite below and Macr. shales above: but where the thickness is so great, quite 1,000 feet, I should say, this seems capable of improvement. In my previous notes, I gave a rough description of the succession of beds there, but it needs expert diagnosis to mark out actual zones. The upper layers at Keera contain *Lyt. adeloides*, *Phyll. disputabile*; *Harp. ignobile* and *Crassefalcatum*, and *Steph. fissum*; the beds below it numerous other species of *Stephanoceras*.

No. 10. Putchum beds. Waagen says that *Opp. cf. Serrigera* marks this upper Putchum bed: however his 3 specimens came from Nurrha, which is on the Cutch mainland, not from Putchum island. I suppose beds lower than Callorian are found at Nurrha as well as in Putchum. Putchum itself produces, it seems, only very badly preserved specimens: and no Ammonites have been found yet in the lower Putchum Stratum, No. 11.

Waagen calculated the main Putchum beds to be Bathonian, chiefly on the character of Molluscs other than Ammonites. The upper-most Putchum beds are Callovian (see his note on Steph. Grantanum).

But though at Keera the Macrocephalus beds full of Ammonites come in regular succession below the Anceps beds, yet in the Ler Hamundra Ellipse only the top Macrocephalus beds appear, to be succeeded by considerable depths of grey sandstone without the sign of an Ammonite. Of this I write above.

J. H. SMITH.

PROCEEDINGS

OF THE MEETING HELD ON 18TH MARCH 1913.

AN "At Home" of members and their friends of the Bombay Natural History Society took place on Tuesday, the 18th March 1913, H. H. the Rao of Cutch, G.C.I.E., presiding.

NEW MEMBERS.

The election of the following 24 members since the last meeting was announced :—

Mr. E. R. Stakelum, Bombay; Mr. C. C. Garbett, I.C.S., Lahore; Mr. E. Alban Williams, Bombay; Mr. E. J. Godfrey, B.Sc., Bangkok; Capt. G. A. Nevill, Sadiya, Assam; the Honorary Secretary, Upper Burma Club, Mandalay; Miss E. A. Montgomery, Broach; Mr. B. C. Rake, Burma; Mr. M. P. Walsh, Bar.-at-Law, Akola, Berar; the Mess President, 98th Infantry, Saugor, C.P.; the Librarian, Students' Library, St. Xavier's College, Bombay; Mr. J. H. Sanders, I.C.S., Ahmednagar; Mr. W. E. Copleston, I.F.S., Belgaum; Mr. R. E. Haslam, Travancore; Capt. H. W. de B. Prescott, Bombay; Mr. R. Trevor Jenkin, I.F.S., Saugor, C.P.; the Honorary Secretary, Library, Peshawar Club, Ltd., Peshawar, N.W.F.P.; Mr. H. D. Coggan, Kamptee, C.P.; Major J. H. Barbour, R.A.M.C., Kamptee, C.P.; Director of Agriculture, Federated Malay States, Kuala Lumpur; Mr. D. D. Nanavati, I.C.S., Burma; Mr. P. A. R. Barron, Bangkok; Mr. Charles S. Prince, Travancore, and Capt. T. R. H. Keppel, Bombay.

ELECTION OF OFFICE BEARERS.

The following gentlemen were elected as office bearers for the present year:—President, H. E. the Right Hon. Lord Sydenham, G.C.M.G., G.C.I.E., G.C.S.I., F.R.S.; Vice-Presidents, Mr. J. D. Inverarity, B.A., LL.B., Rev. F. Dreckmann, S.J., and the Hon. Mr. Justice N. C. Macleod; Honorary Secretary Mr. W. S. Millard; Honorary Treasurer, Mr. L. H. Savile; Managing Committee, Rev. J. Assmuth, S.J., Mr. T. Bainbrigge Fletcher, F.E.S., F.Z.S., Mr. T. R. Bell, I.F.S. Mr. C. L. Burns, Mr. E. Comber, F.Z.S., Lt.-Col. G. H. Evans, F.L.S., C.I.E., Capt. W. H. Evans, R.E., Prof. G. A. Gammie, Mr. E. E. Green, F.E.S., Mr. F. Hannyngton, I.C.S., Mr. G. S. Hardy, I.C.S.; Mr. N. B. Kinnear, Lt.-Col. K. R. Kirtikar, I.M.S. (Retd.), Major W. G. Liston, C.I.E., I.M.S., Mr. McNeill, I.C.S., Dr. A. Powell, Mr. E. L. Sale, I.C.S., Mr. R. A. Spence, Major F. Wall, I.M.S., C.M.Z.S., and Mr. John Wallace, C. E.

THE ACCOUNTS FOR 1912.

Mr. L. H. Savile, the Honorary Treasurer, said in presenting the accounts for the year ending 31st December 1912:—The opening balance at the beginning of the year was Rs. 3,540, the closing balance being Rs. 3,120, showing a deficit on the year's working of Rs. 419. The expenditure during the year was Rs. 37,439, an excess over last year of Rs. 5,947, while the receipts were Rs. 37,019, which is Rs. 4,822 in excess of 1911. So that in spite of a very fair increase in the receipts, the expenditure has exceeded the income. The amount paid in subscription by members during 1912 was Rs. 24,783. The amount actually received for 1912 subscriptions including those paid in 1911 was Rs. 22,431 and there will probably be about Rs. 1,000 still to come in 1913. So we may take it that the amount of subscriptions for the year under review is Rs. 23,500 representing 1,560 members, in addition to 106 life members. The cost of the Journal, plus postage, printing, and stationery and salary of staff (less that of the Keeper of the Museum), amounted to Rs. 24,705 and as

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this represents the cost of the production and issue of the Journal it shows that the subscriptions received from the members does not cover the cost of the production of the Journal in its present form. The number of new members this year as shown by entrance fees was 195, a good increase over last year. As I intimated last year I think the time has now come if we are to maintain the work of the Society in the efficient manner that it is now being carried on, to seriously consider the question of an increase in the annual subscription of members and I would suggest that after the end of the current year the subscription be increased from Rs. 15 to Rs. 20 per annum which would place the Society on a sound financial basis and I hardly think that members, taking into considertion the value they now get in the Journal will object to this small increase.

Mammal Survey Fund.—The opening balance of this fund was Rs. 17,090 and the closing balance Rs 15,517, showing an expenditure over receipts of Rs. 1,572. Donations received during the year amounted to Rs. 11,541. We have had two collectors, Mr. Crump and Mr. Shortridge, working during the year, and it has been decided that the receipts justified our obtaining a third collector (Major Mayor) who will start work early in 1913. The total amount received towards this fund up to the end of 1912, including interest on deposits, amounted to Rs. 35,703 and it is hoped that sufficient further donations may be forthcoming to enable the Society to complete the Mammal Survey of India, Burma and Ceylon.

EXHIBITS.

Mr. G. C. Shortridge exhibited a collection of mammals from Coorg. While there he received a very large amount of assistance from Mr. J. A. Graham, Mr. F. Hannyngton, I.C.S., Mr. H. Cuthell and others, the consequence being that the collection is an exceptionally fine one, comprising a large number of species not hitherto obtained by the Survey. Among the most interesting of these were, the black langur—not previously known to occur North of the Nilgiris—the large short-tailed fruit bat, the leopard cat, Jerdon's toddy cat, the striped necked mongoose —the largest representative of its genus in Asia—the Nilgiri brown mongoose, the hill and clawless otters, the South Indian marton, the pigmy striped squirrel, and the Malabar spiny rat. The others include a very interesting series of three forms of the large Malabar squirrel and the flying squirrel. Besides the species not represented in previous collections—many of the others obtained show very striking variations from those collected further north.

Mr. Mahaluxmiwala exhibited the flowers of the following trees and shrubs grown in the Victoria Gardens, Bombay :—" Cochlospermum gossypium," " Brownea ariza, " " Brownea coccinna," and " Pachira insignis."

H. H. the Rao of Cutch congratulated Mr. Shortridge on the interesting collection of animals which he had made in Coorg and which they saw before them and expressed a hope that his work in Burma and Major Mayor's efforts in Ceylon would result in further valuable collections. His Highness said that he took great interest in the work of the Society and particularly in the Mammal Survey.

A vote of thanks was passed to His Highness for presiding and the meeting terminated.

Owing to the large numbers of specimens exhibited by Mr. Shortridge no specimens presented to the Society since the previous meeting were exhibited.

A full acknowledgment list will however appear in the account of the next meeting.

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